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(54) Data transmission in a radio telephone network

Datenübertragung in einem Funktelefonnetz

Transmission de données dans un réseau radio-téléphonique

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(74) Representative: **Brax, Matti Juhani et al**
Berggren Oy Ab,
P.O. Box 16
00101 Helsinki (FI)

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• **IEEE TRANSACTIONS ON VEHICULAR
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N.M.MITROU ET AL. 'Voice and Data Integration
in the Air-Interface of a Microcellular Mobile
Communication System'**

(73) Proprietor: **Nokia Corporation**
02150 Espoo (FI)

(72) Inventors:

- **Hamalainen, Jari**
SF-33720 Tampere (FI)
- **Jokiaho, Timo**
SF-01620 Vantaa (FI)

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Description

[0001] The present invention relates to the transmission of data in a radio telephone network.

[0002] An example of a radio telephone network, in this case a conventional digital cellular network, is shown in Fig. 1 A. The network comprises Base Station Controllers BSC, each of which control a number of Base Transceiver Stations (BTS). The BTS and the mobile stations are connected via a radio communications channel. The Base Station Controller and the base stations with which it is connected form a Base Station Subsystem. The BSCs are connected to Mobile Switching Centres (MSC) via digital trunk lines which control the base station subsystems. The MSCs route communication traffic to general PSTN or private networks (such as LAN). A Base Station Controller may also be physically located with the Mobile Switching Center. The service range of a base station forms a cell and a Mobile Station within the service range is typically served by the base station. The mobile station is able to move from one cell to another and roam from under the control of one base station controller to be under the control of another controller without losing a connection to the radio telephone network.

[0003] In known cellular networks data information can be transmitted between the home network of a mobile station and a terminal or destination network. The terminal network can include a home network, another network of the same system, a fixed telephone network, or a data network. The network services typically include synchronous and asynchronous circuit-switched data transfer from the cellular network to the external telephone network PSTN, to a circuit-switched data network or an ISDN network. Suggestions have also been made on implementing asynchronous packet switching to an external packet switched data network.

[0004] As shown in Fig. 1A, data transmitted by a mobile station enters a data Inter Working Functions unit, IWF, associated with the Mobile Switching Centre, from there via a modem to the Centre wherfrom it is further transmitted, e.g. via the PSTN, to a target means or target data network, such as a private LAN network. The transition network is thus the general telephone network.

[0005] A typical method of data transmission between networks and also within a network is circuit switching, in which a transfer channel is established for the transfer of data. Establishing a channel is a time-consuming operation and requires a lot of signalling, such as sending a control channel request and assignment of a channel, authentication checks, installation of an encrypting mode and others, before the channel is set up for transferring data information. Circuit switching, when applied for data transfer, is uneconomical since the transfer needs a wide frequency band. Also user is charged irrespective of whether data is transmitted or not. This is because in a circuit-switched network the channel has to be maintained until all data information has been transmitted, which regarding the capacity is uneconomical. Since charging of the user is usually based on the length of the reserved connection time in the circuit-switched network, the user is obliged to pay for "nil" because the time used for the actual data transfer is a minor part of the total connection time. Typically, cellular networks have primarily been optimized for speech transfer, and for that purpose, circuit-switched data transfer is appropriate.

[0006] In digital cellular network, such as in the European GSM network and in the American network of the EIA/TIA (Electronic Industries Association / Telecommunication Industry Association) standards, suggestions have been made on data communication as packets, as so-called data e.g. in the patent US 4,887,265. It discloses a system in which several mobile stations send packet data to one base station using the same channel. When the base station controller receives an assignment request for a data channel from the mobile station, it transmits a channel assignment to the mobile station, whereby the mobile station moves on that data channel. The same channel is also available for use for all other mobile stations within the range of said cell. A request, a channel assignment and transfer on a channel require a considerable amount of signalling. Handover of a data connection from one base station to another is also possible in said system. In the system disclosed by said patent, a permanent channel is provided for packet transfer, being constantly available, irrespective of a momentary need.

[0007] IEEE Transactions on Vehicular Technology 42 (1993) February, No.1 relates to a multiple access protocol in which a mobile terminal connects to a base station in a procedure having three phases, a terminal equipment identity (TEI) assignment phase and then a call set-up phase and an information transfer phase when data is to be transmitted. The call set-up phase has signalling channel reservation and connection set-up sub-phases.

[0008] EP-A-0 048 861 discloses a mobile communication system. A data link is made between two mobile terminals (A and B), through a fixed radio network having a number of data transmission channels and two concentrators. The mobile terminal (A) sends a selector signal (W) to provide virtual part connections, and a virtual end connection at the mobile terminal (B), so a data packet can be transmitted to the mobile terminal (B).

[0009] The data packet is transmitted between exchanges in the fixed radio network. Each concentrator can handle twice as many virtual connections as there are channels. Each channel in either direction has an identification number using six bits; a seventh bit indicates the direction of transmission, and an eighth bit is used for parity checking, thus making an octet. The data section of each packet can be used for numbers, text, facsimile or images, or for phrases in digital speech signals.

[0010] According to a first aspect of the invention there is provided a radio telephone system comprising a mobile

station (MS) and a fixed station (BTS, BSC, MSC, Agent), the mobile station being capable of storing a first parameter, relating to the fixed station, and the fixed station being capable of storing a second parameter, relating to the mobile station, characterised in that the first and second parameters are useable for forming a virtual data communication channel between the mobile station and the fixed station for which authentication has been carried out and encryption has been

5 arranged but which lacks a reserved path, in order that a packet data communication channel can be readily established when packet data is to be communicated between the mobile station and the fixed station by reserving a path for the virtual data communication channel.

[0011] According to a second aspect of the invention there is provided a method of transmitting data in a radio telephone network comprising:

10 storing a first parameter, relating to a fixed station (BTS, BSC, MSC, Agent), in a mobile station (MS);
storing a second parameter, relating to the mobile station, in the fixed station;

15 characterised in that the method comprises forming a virtual data communication channel between the mobile station and the fixed station for which authentication has been carried out and encryption has been arranged but which lacks a reserved path, in order that a packet data communication channel can be readily established when data is to be communicated between the mobile station and the fixed station by reserving a path for the virtual communication channel.

[0012] According to a third aspect of the invention there is provided a radio telephone adapted to store a parameter for setting up a communication channel of a fixed station for forming a virtual data communication channel with the fixed

20 station thereby expediting establishment of a real data communication channel.

[0013] These aspects of the invention provide the advantage that a real data communication channel can be established quickly and when a mobile station desires to transmit data. In between the transmission of data the real data communication channel can be switched to a virtual data communication channel ready for quick reestablishment. Thus, a communication channel does not have to be continually open, even during no actual transmission of data. Thus, the

25 costs of transmitting data are reduced.

[0014] Alternatively, the virtual data communication channel can be formed if a mobile station having data transmission capability registers with the fixed station, or if a mobile station registered with the fixed station requests a data communication channel. An advantage of forming a virtual data communication channel only when a mobile station requests a data communication channel is that unnecessary signalling is avoided.

[0015] Optionally, the data communication channel can be a channel usually reserved for speech transmissions, or signalling or control transmissions. A particular advantage of using signalling or control channels is that the transmission of data does not reduce the number of speech channels available to the users of the system.

[0016] Advantageously, the data communication channel is adapted for transmitting packet data, which is a transmission form particularly suitable for use with a data communication channel which can quickly be opened or closed.

[0017] Another advantage is that data packets can be created at the mobile stations and transferred directly to a data network without the need for transition networks, such as Packet Assembler/Disassemblers (PADS) or using the PSTN. Additionally, the mobile station itself can receive packet data, i.e. the system is bidirectional.

[0018] An appropriate existing cellular system currently in use is, for instance, the European GSM system.

[0019] Embodiments of the invention will now be described by way of example only and with reference to the drawings, 40 in which:-

- Fig. 1 presents a cellular network,
- Fig. 2 is a schematic presentation of the logical channels of the GSM system,
- Fig. 3 illustrates the configuration of a channel request,
- 45 Fig. 4 presents the starting signalling of a virtual channel,
- Fig. 5 presents the steps of transferring packet data,
- Fig. 6 presents the terminating signalling of the virtual channel,
- Fig. 7 presents a phase after a channel has been assembled,
- Fig. 8 is a diagrammatic presentation of a base station,
- 50 Fig. 9 illustrates mobile phone originated data transfer,
- Fig. 10 illustrates data transfer terminating in mobile phone,
- Fig. 11 presents a format of a packet data message,
- Fig. 12 presents a format of another packet data message,
- Fig. 13 presents an order of a RACH frame for a standard burst,
- 55 Fig. 14 presents the phases of a packet data transfer, and
- Fig. 15 presents signalling when a connection is broken at interfaces.

[0020] In a particular example of a cellular network, the physical channel of a mobile station and a base station, that

is, a radio frequency channel, consists of consecutive frames which in turn consist of time slots, in one of which the transmission is performed, the reception in another, in another listening to paging calls, etc. The respective time slots constitute a logical channel, of which a great number there may be available.

[0021] In digital cellular networks, a mobile station can send and receive data on a traffic channel particularly intended for speech and data transfer. Both of them cannot be transmitted simultaneously but the user or the network makes a selection which thereof is to be transferred. Data as well as speech are sent as bursts on a radio channel. This means that in a transmission time slot a brief data burst is transmitted in the middle of the time slot so that a considerable part of the total time used for transmission means the time between the bursts when no information is transferred.

[0022] A particular type of data service known as packet data service has been defined in the GSM network. In said service, the number selected by a data transmitting mobile station informs the network that a circuit-switched connection has to be created to a packet assembling or disassembling unit performing the connection with a data network, such as X.25, which can be a Packet Assembler / Disassembler or a Packet Handler. The Packet Assembler / Disassembler can be placed in association with or also behind the ISDN network. The mobile station sends data as continuous data flow, not as packets, to PAD or PH, which forms the data packets and transmits them onwards via the data network to the target.

If PH is a so-called Basic Packet Handler, the data connection is always located via a given point PH, even in any network. The Basic Data Handler also supports the mobile terminated direction in data transmission. On the other hand, the mobile terminated direction is not supported by the so-called dedicated Packet Handler, nor PAD. The traffic between the mobile station and the packaging means imitates synchronous or asynchronous data transfer, wherebelow a radio traffic protocol RLP is located.

[0023] In the data packet service of the GSM network no packets are produced in the mobile stations, but in PAD. The traffic is unidirectional also in the sense that the connection is mobile station-originated, i.e. the station should send a request to the network for creation of a data connection. No packets can be sent to the mobile station unless the station itself has first requested the opening of a line. It is also to be noted that data is conducted via the telephone network, the pricing of the data transfer whereof being much higher than pricing of transfer within a data network.

[0024] The sending and reception function of data packets can be arranged to be positioned in all mobile stations or in some of them only. For the mobile stations without such function, a packet data transfer is to be completely opaque so that mobile stations of different types are enabled to function without any problems in the network simultaneously. Thus, the packet data feature is an additional service provided by the network, though requiring that the mobile station possesses a property to use such service. The implementation of the system must be such that it requires only a few changes in digital cellular systems in current use and, as an additional feature, it is well appropriate for use in current systems such as GSM, DCS 1800 operating in 1.8 GHz range or PCN.

[0025] In new networks a so-called Short Message Service is most often determined, wherewith a mobile station is enabled to transmit and receive temporally short messages. A transfer of a short message requires, however, a standard connection formation routines, thus requiring part of the frequency band, thus limiting the amount of data to be transferred.

[0026] For transferring packet data no allocated radio channel and data route via the network are maintained continuously. In accordance with the invention, a virtual channel is arranged for data packet transfer in the network between the mobile station and the Mobile Switching Center. When a phone provided with a packet data function enters the range of the Mobile Switching Center, assigned as a user of the packet data service, all necessary signalling is executed, whereafter the Center, or more specifically, the packet data service unit (Agent) in association therewith is provided with all the information it needs concerning the phone and establishing a true transfer channel. Such data, containing in fact information about the location of the phone, is called a virtual channel. The virtual channel is thus a virtual connection between the mobile station and the data service unit, enabling fast transition into data transfer mode, paying regard to the parameters stored in the memories of the mobile station and the data service unit. When packet data has to be transferred from the phone to the network, or vice versa, no complete signalling is needed between the phone and the Center, since that was carried out earlier; instead, a true transfer route can be set up extremely fast and with very low-level signalling between the mobile station and the packet data service unit (Agent), whereon the packets are transferred. The transfer route, or at least the radio channel, is released as soon as there is no packet data to be transferred. Instead, the virtual channel is kept in constant preparedness as long as the mobile station is listed in the data service. In accordance with the present invention, a very rapid connection to the packet data transfer mode can be made, and the transfer route is kept reserved only when there is something to be transferred.

[0027] A means to control the transfer of packet data is arranged to be in conjunction with the Mobile Switching Center, and is known as a data service unit (Agent), which can be a computer or a process. It is a data service center provided with a number of connection services and which has access to other networks and the services thereof. The agent has been placed logically in association with a Mobile Switching Center MSC, though the physical location can be inside the Center as part of the processes thereof or outside the Center in the form of one or more computers connected via a transmission link to the Center. The basis of the Agent is an Interface Unit IFU connecting the cellular network to another network, such as to TCP/IP or OSI network (TCP = Transmission Control Protocol, IP = Internet Protocol, OSI = Open

Systems Interconnection). Thus, a mobile station MS provided with a packet data function communicates by means of the data service unit (Agent) with the other networks, and the virtual channel is placed specifically between it and the data service unit (Agent). Therefore, each mobile station utilizing the packet data service under the control of the Mobile Switching Center is supervised by the data service unit (Agent) in association with the Mobile Switching Center.

5 [0028] The agent performs at least some of the following functions: It

- registers all telephones provided with a packet data function under the control of the Mobile Switching Center,
- informs the phone of a message to arrive,
- removes the phone from the register after terminating of connection,
- 10 - transfers the messages of the phone to the rest of the network,
- transfers the messages from the rest of the network to the phone,
- buffers messages with a view to efficient transmission via the network,
- when necessary, performs encrypting/decrypting,
- when necessary, performs compression / decompression between the phone and the agent,
- 15 - updates the data base thereof (location updating),
- receives messages addressed to the paging channel.

20 [0029] Normally, the virtual channel is initialized when the user starts using the packet data service, and the channel is terminated after the user leaves the service. During the time between the start and the termination, i.e. while being connected with the service, the mobile station is able to move and transfer from one cell to another. The handover function requires disassembling the virtual channel and assembling a new one. The handover is practically unobservable by the user.

25 [0030] When entering the cell area, a mobile station listens to the System Info channel, characteristic of all cellular networks and constant transmission from the base station, being therethrough informed if the packet data service is in use in the network or in the cell. A System Info message may include an identification referring e.g. to the packet data service. When a mobile station wants to be connected to a packet data service, it transmits via a base station to the network a request for setting up a virtual channel. The request commences in the network a standard control signalling sequence utilized thereby and characteristic of said network, in which the authentication of the requester is checked, encrypting is started and the requester is provided with an interim identification number. The agent in association with the Mobile Switching Center, controlling the packet service, is also informed, whereby it includes the supervision of the mobile phone under the control thereof. The Mobile Switching Center maintains an ongoing register on the location of the mobile station, whereby handover from one cell to another is possible and a fast preparedness to transfer to data transmission or reception exists because there is no need for the phone to request separately for a traffic channel.

30 [0031] Instead of a System Info message, it is also possible to operate so that the mobile station requests the network via a short message service whether the packet data function is engaged. The network responds by an equal message of the short message service. The short message services SMS are a service mostly included in the digital networks.

35 [0032] The control signalling associated with the management of the data connection between the data service unit (Agent) in association with the Mobile Station and the Mobile Switching Center MSC is executed along with the data messages in the signalling plane. The functions in the signalling plane are provided with functions for setting up, maintaining and terminating a connection between the cellular network and the other networks. It also includes functions for updating the register, authentication, and a function for providing an interim subscriber number TMSI.

40 [0033] A plurality of protocols are available for use in the transfer of data packets between the mobile station and the data service unit (Agent). The radio interface sets, however, certain limits, such as a requirement for minimizing the amount of data transmitted across the interface. The amount can be minimized by compressing the data section of the packets. The data are compressed prior to transmission e.g. by means of V.42bis compression algorithm, and the receiver decompresses the data using the same algorithm. Also the bit amount in the header of the data packets may be reduced. Such functions are attended to by a Virtual Channel Protocol, which also attends to the control messages between the agent and the mobile station, as well as adapts the packets of the upper protocols into the Radio Link Protocol (RLP) frames.

45 [0034] After the virtual channel has been assembled between the mobile station and the base station, the mobile station can neither start nor receive ordinary calls. Instead, the transmission and reception of short messages SMS is possible.

50 [0035] When wishing to transmit data packets, a mobile station sends a request to the network for channel assignment. Since the majority of the signalling needed in establishing a channel has been already executed at the beginning of creating the virtual connection, the setting up of a data packet transfer channel extending from the mobile station to the agent, required at this moment, is fast. This means a short time from the channel assignment request to transmission of packets.

55 [0036] The transmission may be accomplished according to a first or second embodiment of the invention. When a

user of the mobile station switches off the packet data function on termination of data transmission or when the network terminates the connection, the data route is disassembled and the radio channel is released; optionally, the virtual channel may be maintained.

[0037] A packet data session refers to the time commencing when a user starts a packet data function (informs of his desire to be connected to the service), and ending when the user terminates the service. In the course of the session the user may transmit packets both to a terminal network and receive them from the source network. Roaming and handover are possible. In the course of a session one or several virtual channel connections are created, though only one at a time.

[0038] In accordance with a first embodiment, the radio channel for a data route is a standard traffic channel of a cellular system which is intended for transfer of speech and non-packet shape data via broadcasting between a mobile station and a base station. When wishing to transmit data from a mobile station (i.e. mobile originated), the station requests the network via a base station for a channel using the same signalling channel, as normally used when the station sends a request to connect a call. The signalling channel is a random access channel which all mobile stations of the cell use. The channel runs from the mobile station to the base station, that is, it is a so-called uplink direction channel. Due to the random access, collisions may occur when channel requests enter simultaneously. In such an event the request has to be repeated. The request message includes a special bit configuration, an identification block with which the station reports of a service it wants to have, such as speech, data, packet data; in the present case, the identification configuration indicates that the desired service is transmission of packet data.

[0039] After the network has processed the request and allocated the traffic channel, it transmits to the mobile station on the signalling channel a response containing information as to which traffic channel the station should move on to in order to transmit packet data. The channel on which the network responds to channel requests is a common Access Grant Channel and is in a downlink direction. The mobile station tunes its transmitter on to the allocated traffic channel, and immediately starts transmitting packet data. The transmission lasts until all the data has been transmitted. The network may also start a particular counter or timer when the traffic channel has been allocated, whereby the transmission continues until the counter or timer expires. It is preferred to store the data to be transmitted in a buffer memory of the mobile station and to erase the memory by transmission.

[0040] When packet data is transferred according to the first embodiment via the network to a mobile station (mobile terminated transfer), the only difference to a transfer in the opposite direction is that the network informs the mobile station of a packet data transmission to come. For transmitting such information, a common paging channel is used. All mobile stations within the range of the cell continuously listen to this common downlink paging channel (speech pings are transmitted on this channel). When the mobile station has received a message indicating that packet data is coming in, it acts in the same way as in the mobile-originated case: it transmits a traffic channel request to the base station, receives data on the channel, and moves immediately on to the traffic channel assigned thereto, thus being prepared to receive data packets. On terminated data flow, the network disassembles the traffic channel, so that it is released for use of other mobile stations present within the range of the cell. The data to be transmitted is preferably stored in a data buffer of the data service unit (Agent) and the buffer is erased all at once.

[0041] In accordance with the first embodiment, when transmitting packet data one traffic channel is reserved for such data which is normally used for transferring speech. On terminated transmission, the traffic channel is again free for use by any mobile station. The same mobile station may send another request for packet data transmission, whereby the sequence "channel request-transmission - channel release" can be repeated until the mobile station leaves the packet data service, and the virtual channel is disassembled.

[0042] In accordance with a second embodiment of the invention, a signalling channel or a control channel is used either exclusively or as an alternative to the use of the traffic channel for the transmission of packet data.

[0043] In accordance with the second embodiment, when a mobile station wishes to transmit data packets, i.e. mobile originated transfer, it sends a channel request page to a base station using the same random access channel upon which ordinary channel requests are transmitted. Said channel is in an uplink direction. All mobile stations of the cell employ the same channel for speech channel requests. The Mobile Switching Center decides, after receiving the request, which channel the mobile station should move to for data transmission. The channel can be either a standard traffic channel or a control channel. The control channel can be the same random access channel on which the channel requests are transferred from the mobile stations to the base station. The network establishes a traffic channel provided it has been selected to be the transfer channel. The base station transfers information to the mobile station on whether it is expected to use the standard traffic channel or the control channel for data transmission. Such information is transmitted on the Common Control Channel, on the Access Grant Channel, upon which channel the channel assignment is sent to the mobile stations. The mobile station moves to the traffic or control channel thus assigned, starting immediately to transmit packet data. In the course of the transmission, the channel may be handed over from the traffic channel to the control channel, and vice versa, even several times. On terminated transmission, the channel is disassembled and it is released for other uses. The transfer ends after a given time elapses or when a "packets over" message is received from the station.

[0044] If the network is required to transfer packet data to a mobile station, i.e. mobile terminated transfer, it informs the station via the standard common paging channel of a data packet transmission on the way. The paging includes a particular identification part (bit configuration) indicating that a packet data transfer is in question. In such paging the identification of a second mobile station has been replaced by the user's data section, including a packet coming in to the user from outside. If a packet from outside cannot be accommodated in one data section of the paging message, it is divided into several paging messages, all of which the mobile station receives, gathering one packet therefrom. When the mobile station has received the packet, it acts thereafter in the same way as when desiring to transmit data packets: it transmits a channel request to the base station, receives a channel assignment, moves on the assigned channel, the traffic channel or the control channel, and acknowledges the packet it has received.

[0045] The data route connection between the base station and the agent connected with the Mobile Switching Center can be implemented in a number of ways. One possibility is to reserve a direct connection and to maintain said connection reserved continuously for packet data traffic. This means an ongoing existence of the connection so that no extra delays are formed. The connection can be a PCM time slot or several PCM time slots in the digital trunk line between the Base Station System, BSS and the Mobile Station Center MSC. When a mobile station provided with a packet data reception and transmission property enters the range of the cell in association with the base station, e.g. BTS1 in Fig. 1, the network immediately establishes a direct connection between the base station and the Mobile Switching Center provided for transmission of packet data. The connection can be one or several time slots in the PCM trunk line commonly used by all mobile stations provided with the packet data function. The entry of the mobile station into the cell is known because it has been transferred either as a result of a handover function, or, if entry from outside into the reception area is in question, or the phone is switched on, the phone is registered in the network.

[0046] In an embodiment such as the one described above the PCM channel within the network is constantly maintained but the radio route channel is reserved only when needed.

[0047] The use of the PCM time slots may also be optimized in that a direct connection is maintained only if the Base Station System BSS includes existing virtual connections, that is, at least one cell under the control of the base station controller includes a mobile station connected to the packet data service, being in readiness to receive and transmit packet data. The direct connection is disconnected when no users of the service are found to be in the range of the BSS, and it is set up again when a first mobile station joins the packet data service.

[0048] A second possibility is that connections between the network and radio path are assembled and disassembled when need be. The examples described below include the connections provided according to said second possibility.

[0049] Fig. 1 B shows a typical cellular network such as a GSM network provided with a data packet service in accordance with the invention. A data service unit (Agent) has been connected to a Mobile Switching Center, from where the packet data are conducted directly to a data network according to the OSI or TCP/IP protocol, and from there to a target network, such as a LAN. A difference between this network and the network of Fig. 1 A lies in the fact that no data passes via the circuit-switched telephone network PSTN.

[0050] According to Fig. 2, the logical channels are divided into traffic channels TCH and control channels CCH. The traffic channels are intended for transferring coded speech and data. Each of them can be transferred at full rate or half rate. The control channels CCH are intended to transfer signalling and synchronization data, and three types of channels can be distinguished thus: Broadcast Channels, Common Channels and Dedicated Channels. Below, "uplink" refers to the direction from a mobile station to a base station and "downlink" the direction from a base station to a mobile station.

[0051] The Broadcast Channels comprise the following:

- a Frequency Correction Channel, FCCH, transferring frequency correction data to the mobile station, downlink,
- a Synchronization Channel, SCH, transferring synchronization data to the mobile station and identification data of the base station, downlink
- a Cellular Broadcast Channel, CBCH, short message service, bi-directional channel, and
- a Broadcast Control Channel, BCCH, transferring general information on the base station, downlink.

[0052] The Common Channels comprise the following:

- a Random Access Channel, RACH, uplink direction only, on which the mobile stations send a request for a dedicated channel
- a common Paging Channel, PCH, whereby a base station sends a paging to a mobile station to inform of an incoming call, the channel being in downlink direction only,
- an Access Grant Channel, AGCH, whereby the base station reports of a Stand-alone Dedicated Control Channel, SDCCH, or directly of a Traffic Channel, TCH, said channel being only downlink.

[0053] The Dedicated Control Channels comprise the following:

- a Stand-alone Dedicated Control Channel, bi-directional, and
- a Slow Associated Control Channel and a Fast Associated Control Channel, the channels being bi-directional.

5 In accordance with the present invention, a Traffic Channel (bidirectional), TCH, a Paging Channel, PCH, (unidirectional, downlink), a Random Access Channel, RACH, (unidirectional, uplink), and an Access Grant Channel, AGCH, (unidirectional, downlink) are made use of. Channels of equivalent types can also be found in digital cellular systems other than GSM.

10 The mobile station listens to the Broadcast Transmission Control Channel BCCH transmitted continuously by the base station of the cell and is therethrough informed of a packet data service being engaged in the network. Another procedure is that the mobile station requests on the Cellular Broadcast Channel by transmitting a short message service whether the packet data function is in use in the network or not. The base station sends a short message response on the same channel.

15 When a mobile station sends a request to be a user of a packet data service, a message sequence as shown in Fig. 4 is carried out therebetween and the Mobile Switching Center. The events are read from top to the bottom. After the channel request transmitted by the Mobile Station an immediate assignment of the control channel follows (FACCH), and on the assigned channel the authentication of the requester is checked (the network inquires on the authentication data and the mobile station send a response), encryption is started, and an interim identification number TMSI is allocated. A Radio Link Protocol is established and maintained thereafter permanently. This means that in the course of a session the transmission of data packets can be performed without reassembling the radio link protocol. The data service unit (Agent) in association with the Mobile Switching Center controlling the packet data service is informed, thus transferring the control of the mobile station under the control of its own. The data service unit is now able to detect the mobile station and carry out the encryption and authentication without extra signalling. The virtual channel from the Mobile Switching Center to the mobile station has now been assembled. The radio link protocol is not disassembled before the end of the session (the phone is released from the data packet service) whereby the virtual channel is disassembled.

20 25 When a mobile station wants to transmit data, it transmits a request to set up a transfer channel for real packet data. The request is transmitted on a common Random Access Channel RACH which is similar in configuration to the one shown in Fig. 3. By means of the first three bits of the message the nature of the connection is determined, and sequence 001 referring to a request to set up a data packet connection. The end of the message is a random reference number. The message is a modification of a standard GSM message. The base station receives the request, and after coding the sequence, it informs the mobile station on which control channel the signalling to be performed next is carried out and on which transfer channel the transfer of the packets is to take place. Said phases are described by the two topmost phases in Fig. 15. The transmission channel has been assembled from the mobile station to the base station controller. On a channel produced as above, the mobile station transmits first control messages, the third phase in Fig. 15, wherewith a data connection from the station to the data service unit (Agent) is provided, wherewith the channel from the mobile station to the agent is complete for data transfer.

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[0054] When a true channel, the first part thereof comprising a radio channel and the latter part a PCM time slot, has in the above described manner been established between the mobile station and the base station, the mobile station is able to transmit immediately packet data on said channel. After a demand on data transmission by the network the station transmits data packets, the network acknowledges the packets and sends requests for a repeated transmission if a transmission has been defective. The phases up to that point are presented in -Fig. 5.

[0055] After transmission of all packets, the mobile station sends a request to the network to disassemble the true connection. After receiving the request the network sends an order to the mobile station to terminate the data activities, and the station acknowledges termination of said activities. The phases are presented in Fig. 6. The data packet transfer channel to the base station controller BSC and from there on to the data service unit (Agent) is disassembled. If a method based on direct PCM connection is used, said channel is left on.

[0056] Transfer of packet data may also be directed at the mobile station (i.e. it is mobile terminated). A base station sends on a common paging channel a paging to a mobile station, informing of a packet data transmission on the way. The mobile station then sends a channel request signal to the base station on the common Random Access Channel RACH, whereby the process from that moment onwards is the same as in the mobile oriented case described above: establishing a virtual channel and immediate reception of packet data. In Fig. 7, each of the cases are presented step by step.

[0057] Fig. 8 shows a block diagram of a base station related to the present invention.

[0058] The base station includes several parallel branches formed by the Framing Unit and the Transmitter / Receiver Unit RX/TX. A Base Band Interconnection Element connects the base station to a digital PCM link. Part of the channels of the link are reserved for signalling and the rest for data transfer. The digital signals from the PCM link are conducted to the Framing Unit in which they are arranged into TDMA frames, channel-coded, interleaved and transmitted as bursts onto the radio path via antenna TX. Prior to the transmission, the bursts have been modulated in the transceiver unit

RX/TX and transferred to a carrier wave frequency. When the base station receives a TDMA signal from the mobile station, the signal is conducted via the necessary filters to the transceiver unit RX/TX where it is demodulated, transferred to a carrier frequency, and the modulation is indicated. The channel decoding and discharge of interlacing are performed in the Framing Unit FU. Finally, the data signal is conducted to the PCM line and therefrom via the Mobile Switching Center to the receiving network.

[0059] The base station controller produces all messages transmitted to the radio path, and all received messages are transferred via the base station to the base station controller. Therefore, compared with the GSM currently used, the embodiment of the invention requires only minor changes in the software of the base station controller. Changes have to be made also in the softwares of the mobile station and of the Center. The mobile station has to be able to detect and transmit all messages related to packet data transfer. The messages transmitted by a mobile station can be originated by the user's keyboard or by a separate data terminal connected to the station.

[0060] The invention is described above with a view to assembling a virtual channel without mentioning more closely on which particular radio channel the transmission of data packets will take place.

[0061] In accordance with the first embodiment, the radio channel reserved for packet data transmission is a traffic channel TCH normally used for transmitting speech. On terminated transmission said packet data channel is free for use of any other mobile station. Such first embodiment is described below.

[0062] Reference is made to Fig. 9 showing packet data transfer in mobile station originated mode. The figure is equivalent to Fig. 5 and the description thereof, with an additional remark that also a mentioning has been added therein on which channel each message is transmitted. So, a mobile station sends a packet data channel request to a base station using a common Random Access Channel RACH, which all stations in the cell use when requesting a radio channel. The base station replies by a traffic channel assignment on the common Access Grant Channel AGCH, whereafter the packet data transfer and acknowledgement of reception are carried out on the traffic channel. The paging transmitted on the Random Access Channel RACH contains a value 001 in the "Establishment Cause" as in Fig. 3. Said channel paging request is a modification of a standard channel paging of GSM system. The value "001" would mean that the direction of the packets is from the network to the mobile station. The purpose thereof is so that the value of the "Establishment Cause" field is different in the mobile originated case and the mobile terminated case to ensure that the priority of the mobile terminated case is higher because the network has already been made to prepare a connection.

[0063] The network responds to the paging on the Access Grant Channel AGCH with a message called "Packet Data Assignment". The message is a modification from the standard GSM message "Immediate Assignment". The modification is such that the bit configuration of the "message type" block of said standard message is 00111101 in the present invention, said configuration not being used for any other purposes in GSM. After the message "Packet Data Assignment" the signalling is not continued on the Stand-alone Dedicated Slow Control Channel SDCCH, as the case would be in standard traffic channel trafficking, but on a Faster Associated Control Channel. This should be included in the message sent to the mobile station. The standard message includes an information part "channel description" and it includes an element "channel type". Said element informs that the traffic channel has to be connected with. The bit configuration illustrating the full rate traffic channel TCH and the control channel FACCH associated thereto is "00001". In said element also the timing advance TA and power control are transmitted, these being necessary data for the mobile station.

[0064] When the mobile station has received said above-described modified message, it immediately moves to the traffic channel and starts data packet transmission. If the assembly of the connection between the mobile phone and the Mobile Switching Center requires more signalling prior to transfer of the mobile phone to data packet transmission, the signalling can be carried out on the full rate control channel FACCH.

[0065] The operating time of the traffic channel can be limited relative to the time available or the number of packets. The simplest and most effective method is possibly to transmit all data from the transmission buffer and to release the traffic channel TCH after the buffer is empty. Since the reservation of a true channel takes a few hundreds of milliseconds, a timer can be provided in the telephone counting the time after emptying the buffer. The traffic channel is not released until a set time has elapsed, not immediately after the transmission after the last packet. So, a transmission can be repeated or more transmitted (if more data have been accumulated in the buffer) without setting up a channel. The use of a timer increases the sense of interaction because the channel need not be established again and again in each case. If the transmission rate of the packets is high, the timer keeps the traffic channel TCH continuously reserved and the user receives the replies immediately. The time setting of the timer can be set by the user.

[0066] The operator may also select one traffic channel only in the cell for transferring data packets or equally a great number or even all traffic channels.

[0067] Fig. 10 schematically shows the functions of the first embodiment when packet data are to be sent via the network to a mobile station. The only difference to the opposite case is that the network first informs the mobile station of the packet data transmission to come. The report takes place on the common paging channel PCH in a paging message. When the mobile station has received the paging, the activity is continued, as in the mobile station originated case, that is, the station transmits a channel request to the base station, and the operation goes on as described in association with Fig. 9.

[0068] Fig. 11 shows the formats of a packet data message of an arrangement in accordance with the first embodiment. The packets of the Virtual Channel Protocol, VCP, are produced using the OSI terminology in layer 3, above the link layer, and conducted via Layer 2 Relay Functions, L2R, to the Radio Link Protocol for transmission via the broadcast interface (radio path). The packet includes a header and a data part. The header includes the identification of the upper level protocol to be used. One of the upper level protocols is the protocol of the packet used in the signalling between the station and the agent in association with the Mobile Switching Center. Other potential protocols are Internet Protocol (IP), Open Systems Interconnection (OSI) protocol and some fax protocols. The operator of the network may also add services of his own to be attended to by the Agent, these being provided with identifications of their own. The header may alternatively be also provided with a field informing of the length of the packets. The length of the data part of the packets, or the number of higher level octets, varies. One packet can be transferred in one or more RLP frame.

[0069] A second embodiment of the invention is described, according to which packet data can be transmitted either on a traffic channel TCH or on a common Random Access Channel RACH a channel request, which can be, as above, an 8 bit byte with a bit sequence "001" at the beginning. Thereafter, the network transmits on the Access Grant Channel, AGCH, a message requesting transmission of packet data, said message being a modification of the standard GSM message. The element determining the message type thereof includes bit configuration "00111101", indicating that a packet data case is in question. In block "Channel Type" the bit configuration "00001" indicates that the mobile station should move to the traffic channel TCH to transfer the packet data thereon, and the bit configuration "10000" indicates that it has to stay on the Random Access Channel RACH and to transfer the data packets on that channel. The network makes a decision which channel is to be used. If the telephone traffic in the cell is large scale, the transmission is carried out on the traffic channel, but if it is minor, the Random Access Channel RACH is used.

[0070] The duration of transmission on the Random Access Channel RACH is limited by means of a timer or counter as the Timing Advance, TA, changes very rapidly and the channel reservation occupies the possibilities from the others to request for a connection to be formed.

[0071] Fig. 12 shows the formats of a packet data message of an arrangement in accordance with the second embodiment. Each frame is provided with an 8-bit ordinal number SN acting as identification of a connection. It is generated by the base station and transmitted to the mobile station in conjunction with the assignment message of the packet data. The identification is released after the connection ends. The identification is for the reason necessary that the data included in the same connection with the random access channel and the traffic channel can be combined. Fig. 13 presents a case in which packet data are transmitted on a random access channel. On that channel the packet data are transmitted as standard bursts, and the figure shows the equivalence of the RACH channel frame as standard bursts.

[0072] The mobile station is enabled to present in the form of a wish which of the channels it wants to use for transmitting data. Each TCH and RACH frame is provided with two command bits, informing the channel of the subsequent frame. The connection via the RACH channel can be discontinued if a request to move to the traffic channel TCH arrives, and likewise, the connection via the TCH channel can be discontinued if a request to move to the RACH channel arrives.

[0073] The duration of transmission on the Random Access Channel RACH is limited by means of a timer or counter as the Timing Advance, TA, changes very rapidly and the channel reservation occupies the possibilities from the others to request for a connection to be formed.

[0074] The mobile station is enabled to present in the form of a wish which of the channels it wants to use for transmitting data. Each TCH and RACH frame is provided with two command bits, informing the channel of the subsequent frame. The connection via the RACH channel can be discontinued if a request to move to the traffic channel TCH arrives, and likewise, the connection via the TCH channel can be discontinued if a request to move to the RACH channel arrives. The command bits C at the ends of the frames are available for use of the mobile station for a channel shift request and moreover, the termination of a data transfer can be reported therethrough. Said two bits can therefore be used as follows:

- bits "11" = move to the same channel
- bits "01" = move to traffic channel TCH
- bits "10" = switch to the common Random Access Channel and the common Paging Channel PCH
- bits "00" = transmission over.

[0075] The switching on the transmission channel can be implemented in two ways. After the switch-on-the-channel command transfer, the mobile station is allowed to request for a channel in a "packet data channel request" message and to wait for a channel assignment message to be able to select the channel on which the data traffic will take place. Another alternative is to read the message on the network side and if a channel switching is requested in the command bits, the "packet data assignment" message is sent without any "packet data request" message. The packet has been transferred to a plurality of RLP frames. One of the RLP frames is interlaced into 22 standard bursts of the TCH channel.

[0076] The transmission of data packets is described above in mobile station-originated mode in an instance according to the second embodiment. The instance in which packet data are transmitted via the network to a mobile station differs from the above-mentioned case only in that the network reports the mobile station of future transmission in a particular "packet data paging request" message which it sends on a common Paging Channel. The message is a modification of the paging of the GSM system being provided with a free bit configuration for this purpose. "001000011" is selected for the bit configuration. As an extension, a data field is added in the message, wherein the data to be transmitted to the user is transferred. After receiving said paging message (or a series of paging messages including the packet), the mobile station opens a connection and acknowledges the packet.

[0077] Fig. 14 presents schematically the events in temporal order when transmitting data packets via the network to

the mobile station. The packet transfer takes first place on a traffic channel, moves on a random access channel, returns on the traffic channel and then on the random access channels. On the random access channels the trafficking time runs out, and the connection is terminated forcedly.

[0076] In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention.

Claims

10. 1. A radio telephone system comprising a mobile station (MS) and a fixed station (BTS, BSC, MSC, Agent), the mobile station being capable of storing a first parameter, relating to the fixed station, and the fixed station being capable of storing a second parameter, relating to the mobile station,
the first and second parameters are useable for forming a virtual data communication channel between the mobile station and the fixed station for which authentication has been carried out and **characterised in that** for said virtual data communication channel encryption has been arranged but which lacks a reserved path, in order that a packet data communication channel can be readily established when packet data is to be communicated between the mobile station and the fixed station by reserving a path for the virtual data communication channel.
15. 2. A system according to claim 1, adapted to form the virtual data communication channel when a mobile station (MS) having data communication capability registers with the fixed station (BTS, BSC, MSC, Agent).
20. 3. A system according to claim 1 or claim 2, adapted to form the virtual data communication channel when a mobile station (MS) registered with the fixed station (BTS, BSC, MSC, Agent) requests the setting up of a packet data communication channel.
25. 4. A system according to any of claims 1 to 3, further comprising means for forming traffic channels, usually reserved for speech communication between the mobile station (MS) and the fixed station (BTS, BSC, MSC, Agent), and wherein a channel usually reserved for speech communication (TCH) is the path reserved for the packet data communication channel.
30. 5. A system according to any of claims 1 to 3, further comprising means for forming control channels between the mobile station (MS) and the fixed station (BTS, BSC, MSC, Agent), and wherein a control channel (RACH, PCH, AGCH) is the path reserved for the packet data communication channel.
35. 6. A system according to any preceding claim, wherein there is provided control means (Agent) for controlling communication between the mobile station (MS), the fixed station (BTS, BSC, MSC, Agent) and an external communication network (Wide Area Network, Remote LAN).
40. 7. A system according to any preceding claim for providing a data service comprising a digital time-division cellular network having a Mobile Switching Center (MSC), a base station controller (BSC) connected thereto, and a plurality of base stations (BTS) connected to the base station controller, and a plurality of mobile stations (MS), the system comprising means for forming a traffic channel for transfer of speech and data and control channels in association with the traffic channel between the mobile station and the base station, the control channels comprising:
 - 45. - a random access channel (RACH), whereon the mobile stations request a traffic channel,
 - a common paging channel (PCH), whereon a base station sends a paging signal to a mobile station,
 - an access grant channel (AGCH), whereon the base station informs the mobile station of the traffic channel assigned thereto,
50. 8. A system according to claim 7 comprising:
 - 55. - means for switching at least one of the plurality of mobile station (MS) to the packet data service unit (Agent) and signalling for the setting up of a connection to the data network,
 - means in a mobile station and the packet data service unit for storing a number of parameters relating to each other, the parameters including a radio link protocol and forming the virtual data communication channel,

5 - means, responsive to a request from a mobile station to transfer or receive data packets, for assembling a packet data transfer channel between the mobile station and the packet data service unit, making use of the parameters of the virtual data communication channel, and wherein the packet data transfer channel comprises a first part comprising a radio channel between the mobile station and the base station (BTS) and a second part comprising a time slot in a digital trunk line between the base station and the packet data service unit,
- means for transferring data packets over the packet data transfer channel,
- means, responsive to the termination of data packet transfer over the packet data transfer channel, for disassembling at least the radio channel, and
- means for maintaining the virtual channel until the release of a mobile station from the packet data service unit.

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9. A system according to claim 7 or claim 8, wherein the packet data service unit (Agent) comprises means for:

15 - registering all mobile stations (MS) connected to a packet data service under the control of the Mobile Switching Center (MSC) in a register,
- informing the mobile station of any data packets addressed thereto,
- transferring data packets sent by the mobile station addressed to the network,
- transferring messages to the mobile station from the network,
- buffering data packets,
- performing encrypting / decrypting,
20 - performing compression /decompression of data sent to and from the mobile station,
- updating a database of the location of the mobile stations,
- receiving the data packets addressed to the paging channel (PCH),
- removing the mobile station from the register after it is disconnected from the packet data service.

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10. A system according to any of claims 7 to 9, wherein the packet data service unit (Agent) is capable of adapting the data packets from the network layer to virtual channel protocol packets, the virtual channel protocol packets being composed of one or more radio traffic protocol frames.

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11. A system according to claim 10, wherein a virtual channel protocol packet is provided with an identification part indicating whether the contents of a packet contain signalling data or an upper layer data packet.

12. A system according to any of claims 7 to 11, wherein when a mobile station (MS) wants to transmit data packets, it sends on the random access channel (RACH) a request for establishing the packet data communication channel, the request being a modification of the standard request of the network.

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13. A system according to any of claims 7 to 12, wherein when data packets are transferred to the mobile station (MS), the base station (BTS) sends a message to the mobile station on the common paging channel (PCH) about a data packet transfer to come, whereafter the mobile station sends on the random access channel (RACH) a request to the base station for establishing the packet data communication channel, the request being a modification of the standard channel request of the network.

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14. A system according to claim 12 or 13, wherein the base station (BTS) transmits to the mobile station (MS) control channel data used in signalling and data concerning the channel to be reserved in forming the packet data communication channel.

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15. A system according to claim 14, wherein after signalling between the mobile station (MS) and the packet data service unit (Agent), the second part of the packet data transfer channel is established, whereby the entire packet data transfer channel is ready for packet transfer.

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16. A system according to claim 15, wherein the signalling is carried out on a Dedicated Fast Access Channel (FACCH) of the network.

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17. A system according to any of claims 7 to 16, wherein the second part of the packet data transfer channel is a direct PCM connection from the base station controller (BSC) of the base station (BTS) to the packet data service unit (Agent), whereby the second part of the packet data transfer channel is active irrespective of whether packet data transfer is occurring.

18. A system according to any of claims 7 to 17, wherein the second part of the packet data transfer channel is a variable

time slot on the PCM trunk line, whereby the second part is disassembled after the termination of the packet data transfer.

5 19. A system according to any of claims 7 to 18, wherein the first part of the packet data transfer channel comprises a traffic channel (TCH).

10 20. A system according to any of claims 7 to 18, wherein the first part of the packet data transfer channel comprises a random access channel (RACH) when packet data are transferred from the mobile station (MS) to the packet data service unit (Agent) and comprises the common paging channel (PCH) when packet data are transferred from the packet data service unit to the mobile station.

15 21. A system according to any of claims 7 to 18, wherein in the course of a transfer of packet data, the first part of the packet data transfer channel is selected from a group consisting of the traffic channel (TCH), the random access channel (RACH), and the common paging channel (PCH).

20 22. A system according to any of claims 7 to 21, wherein a broadcast paging message transmitted to all mobile stations (MS) of a cell and a multicast paging message transmitted to certain mobile stations are transmitted on the data section of a broadcast and a multicast protocol respectively.

25 23. A system according to any preceding claim wherein the first and second parameters are those used in authentication.

26 24. A system according to any preceding claim wherein the first and second parameters are those used in encryption.

27 25. A system according to any preceding claim wherein the first and second parameters are those used in forming a radio link protocol.

28 26. A system according to any preceding claim wherein at least one of the first and second parameters is an interim identification number (TMSI).

30 27. A system according to any preceding claim comprising means for forming the virtual data communication channel by sending a channel request from the mobile station (MS) to the fixed station (BTS, BSC, MSC, Agent), means for assigning a radio channel, means for authenticating the mobile station on the assigned radio channel, means for starting encrypted communication between the mobile station and the fixed station, and means for allocating an interim identification number (TMSI) to the mobile station.

35 28. A system according to claim 27 wherein the assigned radio channel is a control channel.

40 29. A system according to any preceding claim comprising means for forming the virtual data communication channel by establishing a radio link protocol and maintaining the radio link protocol until the mobile station (MS) is released from the data packet service.

45 30. A system according to any preceding claim in which the virtual communication channel can be maintained after the packet data communication channel is released.

46 31. A method of transmitting data in a radio telephone network comprising:

47 storing a first parameter, relating to a fixed station (BTS, BSC, MSC, Agent), in a mobile station (MS);
 50 storing a second parameter, relating to the mobile station, in the fixed station; forming a virtual data communication channel by using the first and second parameters between the mobile station and the fixed station for which authentication has been carried out and **characterised in that** encryption has been arranged for said virtual data communication channel but which, lacks a reserved path, in order that a packet data communication channel can be readily established when data is to be communicated between the mobile station and the fixed station by reserving a path for the virtual data communication channel.

55 32. A method according to claim 31, further comprising forming the virtual data communication channel when a mobile station (MS) having data communication capability registers with the fixed station (BTS, BSC, MSC, Agent).

56 33. A method according to claim 31 or claim 32, further comprising forming the virtual data communication channel

when a mobile station (MS) registered with the fixed station (BTS, BSC, MSC, Agent) requests the setting up of a packet data communication channel.

5 34. A method according to any of claims 31 to 33, further comprising reserving a communication channel usually reserved for speech communication for the packet data communication channel.

10 35. A method according to any of claims 31 to 34, further comprising reserving a control channel for the data communication channel.

15 36. A method according to any of claims 31 to 35 wherein the first and second parameters used to set up the data communication channel are those used in authentication.

15 37. A method according to any of claims 31 to 36 wherein the first and second parameters used to set up the data communication channel are those used in encryption.

15 38. A method according to any of claims 31 to 37 wherein the first and second parameters used to set up the data communication channel are those used in forming a radio link protocol.

20 39. A method according to any of claims 31 to 38 wherein at least one of the first and second parameters is an interim identification number (TMSI).

25 40. A method according to any preceding claim comprising the steps of forming the virtual data communication channel by sending a channel request from the mobile station (MS) to the fixed station (BTS, BSC, MSC, Agent), assigning a radio channel, authenticating the mobile station on the assigned radio channel, starting encrypted communication between the mobile station and the fixed station, and then allocating an interim identification number (TMSI) to the mobile station.

41. A method according to claim 40 wherein the assigned radio channel is a control channel.

30 42. A method according to any of claims 31 to 41 comprising the steps of forming the virtual data communication channel by establishing a radio link protocol and maintaining the radio link protocol until the mobile station (MS) is released from the data packet service.

35 43. A method according to any of claims 31 to 42, wherein control means (Agent) controls communication between the mobile station (MS), the fixed station (NTS, BSC, MSC, Agent) and an external communication network (Wide Area Network, Remote LAN).

40 44. A method according to any preceding claim in which the virtual communication channel can be maintained after the packet data communication channel is released.

45 45. A mobile station (MS) adapted to operate in a radio telephone system comprising a fixed station (BTS, BSC, MSC, Agent), the mobile station being adapted to store a parameter relating to the fixed station, the mobile station is capable of forming a virtual data communication channel between itself and the fixed station by using the parameter that the mobile station stores relating to the fixed station as well as a parameter that the fixed station stores relating to the mobile station for which authentication has been carried out and **characterised in that** for said virtual data communication channel encryption has been arranged but which lacks a reserved path, in order that a packet data communication channel can be readily established when data is to be communicated between the mobile station and the fixed station by reserving a path for the virtual data communication channel.

50 46. A mobile station (MS) according to claim 45, adapted to store the parameter when the mobile station registers with the fixed station (BTS, BSC, MSC, Agent).

55 47. A mobile station (MS) according to claim 45 or claim 6, adapted to store the parameter when the mobile station is registered with the fixed station (BTS, BSC, MSC, Agent) and requests the setting up of a packet data communication channel.

48. A fixed station (BTS, BSC, MSC, Agent) adapted to operate in a radio telephone system comprising a mobile station (HS) the fixed station being adapted to store a parameter relating to the mobile station, the fixed station is capable

of forming a virtual data communication channel between itself and the mobile station by using the parameter that the fixed station stores relating to the mobile station as well as a parameter that the mobile station stores relating to the fixed station for which authentication has been carried out and **characterised in that** for said virtual data communication channel encryption has been arranged but which lacks a reserved path, in order that the packet data communication channel can be readily established when data is to be communicated between the mobile station and the fixed station by reserving a path for the virtual data communication channel.

5 **49.** A fixed station (BTS, BSC, MSC, Agent) according to claim 48, adapted to store the parameter when the radio telephone registers with the fixed station (BTS, BSC, MSC, Agent).

10 **50.** A fixed station (BTS, BSC, MSC, Agent) according to claim 48 or claim 49, adapted to store the parameter when the radio telephone is registered with the fixed station (BTS, BSC, MSC, Agent) and requests the setting up of a packet data communication channel.

15 **51.** A fixed station (BTS, BSC, MSC, Agent) according to any preceding claim in which the virtual communication channel can be maintained after the packet data communication channel is released.

Patentansprüche

20 **1.** Funktelefonsystem, umfassend eine Mobilstation (MS) und eine feste Station (BTS, BSC, MSC, Agent), wobei die Mobilstation dazu in der Lage ist, einen ersten Parameter zu speichern, der die feste Station betrifft, und die feste Station dazu in der Lage ist, einen zweiten Parameter zu speichern, der die Mobilstation betrifft, wobei der erste und der zweite Parameter benutzt werden können, um einen virtuellen Datenkommunikationskanal zwischen der Mobilstation und der festen Station zu bilden, für den eine Authentifizierung ausgeführt wurde, **dadurch gekennzeichnet, dass** für den virtuellen Datenkommunikationskanal eine Verschlüsselung eingerichtet worden ist, dieser jedoch keinen reservierten Pfad aufweist, so dass ein Paketdaten-Kommunikationskanal ohne weiteres erstellt werden kann, wenn Paketdaten zwischen der Mobilstation und der festen Station ausgetauscht werden sollen, indem ein Pfad für den virtuellen Datenkommunikationskanal reserviert wird.

30 **2.** System nach Anspruch 1, das angepasst ist, um den virtuellen Datenkommunikationskanal zu bilden, wenn sich eine Mobilstation (MS) mit einer Datenkommunikationsfähigkeit bei der festen Station (BTS, BSC, MSC, Agent) registriert.

35 **3.** System nach Anspruch 1 oder Anspruch 2, das angepasst ist, um den virtuellen Datenkommunikationskanal zu bilden, wenn eine Mobilstation (MS), die sich bei der festen Station (BTS, BSC, MSC, Agent) registriert hat, die Einrichtung eines Paketdaten-Kommunikationskanals anfordert.

40 **4.** System nach einem der Ansprüche 1 bis 3, ferner umfassend Mittel zum Bilden von Verkehrskanälen, die gewöhnlich für Sprachkommunikationen zwischen der Mobilstation (MS) und der festen Station (BTS, BSC, MSC, Agent) reserviert sind, und wobei ein Kanal, der gewöhnlich für Sprachkommunikation (TCH) reserviert ist, der Pfad ist, der für den Paketdaten-Kommunikationskanal reserviert ist.

45 **5.** System nach einem der Ansprüche 1 bis 3, ferner umfassend Mittel zum Bilden von Steuerkanälen zwischen der Mobilstation (MS) und der festen Station (BTS, BSC, MSC, Agent), und wobei ein Steuerkanal (RACH, PCH, AGCH) der Pfad ist, der für den Paketdaten-Kommunikationskanal reserviert ist.

50 **6.** System nach einem der vorhergehenden Ansprüche, wobei ein Steuermittel (Agent) zum Steuern der Kommunikation zwischen der Mobilstation (MS), der festen Station (BTS, BSC, MSC, Agent) und einem externen Kommunikationsnetzwerk (Fernnetz, Fern-LAN) bereitgestellt wird.

55 **7.** System nach einem der vorhergehenden Ansprüche zum Bereitstellen eines Datendienstes, der ein digitales zelluläres Zeitvielfachnetzwerk umfasst, das eine mobile Schaltstelle (MSC), eine Basisstationssteuerung (BSC), die damit verbunden ist, mehrere Basisstationen (BTS), die mit der Basisstationssteuerung verbunden sind, und mehrere Mobilstationen (MS) aufweist, wobei das System Mittel zum Bilden eines Verkehrskanals zur Übertragung von Sprache und Daten und Steuerkanäle in Verbindung mit dem Verkehrskanal zwischen der Mobilstation und der Basisstation umfasst, wobei die Steuerkanäle umfassen:

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- einen wahlfreien Zugriffskanal (RACH), auf dem die Mobilstationen einen Verkehrskanal anfordern
- einen allgemeinen Rufkanal (PCH), auf dem eine Basisstation ein Rufsignal an eine Mobilstation sendet,
- einen Zugriffsgenehmigungskanal (AGCH), auf dem die Basisstation die Mobilstation über den ihr zugewiesenen Verkehrskanal informiert,

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wobei das Steuermittel eine Paketdatendiensteinheit (Agent) ist und mit der mobile Schaltstelle verbunden ist, um das zellulare Netzwerk mit einem Datennetzwerk (Pennetz, Fern-LAN) zu verbinden.

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8. System nach Anspruch 7, umfassend:

- Mittel zum Umschalten mindestens einer der mehreren Mobilstationen (MS) zu einer Paketdatendiensteinheit (Agent) und zum Signalisieren der Einrichtung einer Verbindung zu dem Datennetzwerk,
- Mittel in einer Mobilstation und der Paketdatendiensteinheit zum Speichern einer Anzahl von Parametern, die miteinander in Beziehung stehen, wobei die Parameter ein Funkverknüpfungsprotokoll aufweisen und den virtuellen Datenkommunikationskanal bilden,
- Mittel, die auf eine Anfrage von einer Mobilstation antworten, um Datenpakete zu übertragen oder zu empfangen, um einen Paketdaten-Übertragungskanal zwischen der Mobilstation und der Paketdatendiensteinheit zu erstellen, wobei Parameter des virtuellen Datenkommunikationskanals benutzt werden, und

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wobei der Paketdaten-Übertragungskanal einen ersten Teil, der einen Funkkanal zwischen der Mobilstation und der Basisstation (BTS) umfasst, und einen zweiten Teil umfasst, der einen Zeitschlitz in einer digitalen Hauptleitung zwischen der Basisstation und der Paketdatendiensteinheit umfasst,

25

- Mittel zum Übertragen von Datenpaketen über den Paketdaten-Übertragungskanal,
- Mittel, die über den Paketdaten-Übertragungskanal auf die Beendigung der Datenpaketübertragung antworten, um mindestens den Funkkanal abzubauen, und
- Mittel zum Erhalten des virtuellen Kanals bis zu der Freigabe einer Mobilstation aus der Paketdatendiensteinheit.

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9. System nach Anspruch 7 oder Anspruch 8, wobei die Paketdatendiensteinheit (Agent) Mittel umfasst zum:

- Registrieren aller Mobilstationen (MS), die mit einem Paketdatendienst unter der Steuerung der mobilen Schaltstelle (MSC) in dem Register verbunden sind,
- Informieren der Mobilstation über jegliche Patenpakete, die an sie gerichtet sind,
- Übertragen von Datenpaketen, die von der Mobilstation gesendet werden, die an das Netzwerk gerichtet ist,
- Übertragen von Mitteilungen an die Mobilstation von dem Netzwerk,
- Puffern von Datenpaketen,
- Ausführen einer Verschlüsselung / Entschlüsselung
- Ausführen einer Komprimierung / Dekomprimierung von Daten, welche an die und von der Mobilstation gesendet werden,
- Aktualisieren einer Datenbank des Standortes der Mobilstationen
- Empfangen der Datenpakete, die an den Rufkanal (PCH) gerichtet sind,
- Entfernen der Mobilstation aus dem Register, nachdem sie von dem Paketdatendienst getrennt worden ist.

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10. System nach einem der Ansprüche 7 bis 9, wobei die Paketdatendiensteinheit (Agent) dazu in der Lage ist, die Datenpakete aus der Netzwerkschicht an die virtuellen Kanalprotokollpakete anzupassen, wobei die virtuellen Kanalprotokollpakete aus einem oder mehreren Funkverkehrs-Protokollrahmen zusammengesetzt sind.

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11. System nach Anspruch 10, wobei ein virtuelles Kanalprotokollpaket mit einem Identifizierungsteil bereitgestellt wird, der anzeigt, ob die Inhalte eines Pakets Signalisierungsdaten oder ein Datenpaket der Oberschicht enthalten.

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12. System nach einem der Anspruch 7 bis 11, wobei, wenn eine Mobilstation (MS) Datenpakete übertragen möchte, diese auf dem wahlfreien Zugangskanal (RACH) eine Anfrage sendet, um den Paketdaten-Kommunikationskanal zu erstellen, wobei die Anfrage eine Modifikation der Standardanfrage des Netzwerks ist.

13. System nach einem der Ansprüche 7 bis 12, wobei Datenpakete an die Mobilstation (MS) übertragen werden, die Basisstation (BTS) auf dem allgemeinen Rufkanal (PCH) eine Mitteilung über eine zukünftige Datenpaketübertragung an die Mobilstation sendet, wonach die Mobilstation auf dem wahlfreien zugangskanal (RACH) eine Anfrage

an die Basisstation senden, um den Paketdaten-Kommunikationskanal zu erstellen, wobei die Anfrage eine Modifikation der Standardkanalanfrage des Netzwerkes ist.

14. System nach Anspruch 12 oder 13, wobei die Basisstation (BTS) Steuerkanaldata, die bei der Signalisierung benutzt werden, und Daten, welche den bei der Bildung des Paketdaten-Kommunikationskanal zu reservierenden Kanal betreffen, an die Mobilstation (MS) überträgt.
5
15. System nach Anspruch 14, wobei nach dem Signalisieren zwischen der Mobilstation (MS) und der Paketdatendiensteinheit (Agent) der zweite Teil des Paketdaten-Übertragungskanals erstellt wird, wobei der gesamte Paketdaten-Übertragungskanal zur Paketübertragung bereit ist.
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16. System nach Anspruch 15, wobei das Signalisieren auf einem dedizierten Schnellzugangskanal (FACCH) des Netzwerks ausgeführt wird.
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17. System nach einem der Ansprüche 7 bis 16, wobei der zweite Teil des Paketdaten-Übertragungskanals eine direkte PCM-Verbindung von der Basisstationssteuerung (BSC) der Basisstation (BTS) zu der Paketdatendiensteinheit (Agent) ist, wobei der zweite Teil des Paketdaten-Übertragungskanals ungeachtet der Tatsache, ob die Paketdatenübertragung eintritt, aktiv ist.
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18. System nach einem der Ansprüche 7 bis 17, wobei der zweite Teil des Paketdaten-Übertragungskanals ein variabler Zeitschlitz auf der PCM-Hauptleitung ist, wobei der zweite Teil nach Beendigung der Paketdatenübertragung getrennt wird.
25
19. System nach einem der Ansprüche 7 bis 18, wobei der erste Teil des Paketdaten-Übertragungskanals einen Verkehrskanal (TCH) umfasst.
25
20. System nach einem der Ansprüche 7 bis 18, wobei der erste Teil des Paketdaten-Übertragungskanals einen wahlfreien Zugangskanal (RACH) umfasst, wenn Paketdaten von der Mobilstation (MS) zu der Paketdatendiensteinheit (Agent) übertragen werden, und den allgemeinen Rufkanal (PCH) umfasst, wenn Paketdaten von der Paketdatendiensteinheit an die Mobilstation übertragen werden.
30
21. System nach einem der Ansprüche 7 bis 18, wobei im Laufe einer Übertragung von Paketdaten der erste Teil des Paketdaten-Übertragungskanals ausgewählt wird aus der Gruppe, bestehend aus dem Verkehrskanal (TCH), dem wahlfreien Zugangskanal (RACH) und dem allgemeinen Rufkanal (PCM).
35
22. System nach einem der Ansprüche 7 bis 21, wobei eine Übertragungsrufmitteilung, die an alle Mobilstationen (MS) einer Zelle übertragen wird, und eine Gruppenrufmitteilung, die an bestimmte Mobilstationen übertragen wird, auf dem Datenabschnitt jeweils eines Übertragungs- und eines Gruppenrufprotokolls übertragen werden.
40
23. System nach einem der vorhergehenden Ansprüche, wobei der erste und der zweite Parameter diejenigen sind, die zur Authentifizierung benutzt werden.
45
24. System nach einem der vorhergehenden Ansprüche, wobei der erste und der zweite Parameter diejenigen sind, die bei der Verschlüsselung benutzt werden.
45
25. System nach einem der vorhergehenden Ansprüche, wobei der erste und der zweite Parameter diejenigen sind, die bei der Bildung eines Funkverknüpfungsprotokolls benutzt werden.
50
26. System nach einem der vorhergehenden Ansprüche, wobei mindestens einer des ersten und des zweiten Parameters eine Zwischenidentifizierungsnummer (TMSI) ist.
55
27. System nach einem der vorhergehenden Ansprüche, umfassend Mittel zum Bilden des virtuellen Datenkommunikationskanals durch Senden einer Kanalanfrage von der Mobilstation (MS) an die feste Station (BTS, BSC, MSC, Agent), Mittel zum Zuweisen eines Funkkanals, Mittel zum Authentifizieren der Mobilstation auf dem zugewiesenen Funkkanal, Mittel zum Beginnen der verschlüsselten Kommunikation zwischen der Mobilstation und der festen Station, und Mittel zum Zuteilen einer Zwischenidentifizierungsnummer (TMSI) zu der Mobilstation.

28. System nach Anspruch 27, wobei der zugewiesene Funkkanal ein Steuerkanal ist.

29. System nach einem der vorhergehenden Ansprüche, umfassend Mittel zum Bilden des virtuellen Datenkommunikationskanals durch Erstellen eines Funkverknüpfungsprotokolls und Erhalten des Funkverknüpfungsprotokolls, bis die Mobilstation (MS) von dem Datenpaketdienst freigestellt wird.

30. System nach einem der vorhergehenden Ansprüche, in dem der virtuelle Kommunikationskanal erhalten werden kann, nachdem der Paketdaten-Übertragungskanal freigegeben worden ist.

10 31. Verfahren zum Übertragen von Daten in einem Funktelefonnetzwerk, umfassend:

15 Speichern eines ersten Parameters, der eine feste Station (BTS, BSC, MSC, Agent) betrifft, in einer Mobilstation (MS);
Speichern eines zweiten Parameters, der die Mobilstation betrifft, in der festen Station;
Bilden eines virtuellen Datenkommunikationskanals durch Benutzen des ersten und des zweiten Parameters zwischen der Mobilstation und der festen Station, für welche die Authentifizierung ausgeführt worden ist, **dadurch gekennzeichnet, dass** für den virtuellen Datenkommunikationskanal eine Verschlüsselung vorgenommen worden ist, dieser jedoch keinen reservierten Pfad aufweist, so dass ein Paketdaten-Übertragungskanal ohne weiteres erstellt werden kann, wenn Daten zwischen der Mobilstation und der festen Station durch Reservieren eines Pfads für den virtuellen Datenkommunikationskanal ausgetauscht werden sollen.

20 32. Verfahren nach Anspruch 31, ferner umfassend das Bilden des virtuellen Datenkommunikationskanals, wenn sich eine Mobilstation (MS) mit einer Datenkommunikationsfähigkeit bei der festen Station (BTS, BSC, MSC, Agent) registriert.

25 33. Verfahren nach Anspruch 31 oder Anspruch 32, ferner umfassend das Bilden des virtuellen Datenkommunikationskanals, wenn eine Mobilstation (MS), die bei der festen Station (BTS, BSC, MSC, Agent) registriert ist, die Einrichtung eines Paketdaten-Kommunikationskanals anfordert.

30 34. Verfahren nach einem der Ansprüche 31 bis 33, ferner umfassend das Reservieren eines Kommunikationskanals, der gewöhnlich zur Sprachkommunikation für den Paketdaten-Kommunikationskanal reserviert ist.

35 35. Verfahren nach einem der Ansprüche 31 bis 34, ferner umfassend das Reservieren eines Steuerkanals für den Datenkommunikationskanal.

36. Verfahren nach einem der Ansprüche 31 bis 35, wobei der erste und der zweite Parameter, die zum Einrichten des Datenkommunikationskanals benutzt werden, diejenigen sind, die bei der Authentifizierung benutzt werden.

40 37. Verfahren nach einem der Ansprüche 31 bis 36, wobei der erste und der zweite Parameter, die zum Einrichten des Datenkommunikationskanals benutzt werden, diejenigen sind, die bei der Verschlüsselung benutzt werden.

38. Verfahren nach einem der Ansprüche 31 bis 37, wobei der erste und der zweite Parameter, die zum Einrichten des Datenkommunikationskanals benutzt werden, diejenigen sind, die bei der Bildung eines Funkverknüpfungsprotokolls benutzt werden.

45 39. Verfahren nach einem der Ansprüche 31 bis 38, wobei mindestens einer des ersten und des zweiten Parameters eine Zwischenidentifizierungsnummer (TMSI) ist.

40. Verfahren nach einem der vorhergehenden Ansprüche, umfassend die Schritte Bilden des virtuellen Datenkommunikationskanals durch Senden einer Kanalanfrage von der Mobilstation (MS) an die feste Station (BTS, BSC, MSC, Agent), Zuweisen eines Funkkanals, Authentifizieren der Mobilstation auf dem zugewiesenen Funkkanal, Beginnen der verschlüsselten Kommunikation zwischen der Mobilstation und der festen Station, und danach Zuteilen einer Zwischenidentifizierungsnummer (TMSI) zu der Mobilstation.

55 41. Verfahren nach Anspruch 40, wobei der zugewiesene Funkkanal ein Steuerkanal ist.

42. Verfahren nach einem der Ansprüche 31 bis 41, umfassend die Schritte Bilden des virtuellen Datenkommunikationskanals durch Erstellen eines Funkverknüpfungsprotokolls und Erhalten des Funkverknüpfungsprotokolls, bis

die Mobilstation (MS) von dem Datenpaketdienst freigestellt wird.

43. Verfahren nach einem der Ansprüche 31 bis 42, wobei das Steuermittel (Agent) die Kommunikation zwischen der Mobilstation (MS) und der festen Station (NTS, BSC, MSC, Agent) und einem externen Kommunikationsnetzwerk (Fernnetz, Fern-LAN) steuert.

44. Verfahren nach einem der vorhergehenden Ansprüche, in dem der virtuelle Kommunikationskanal erhalten werden kann, nachdem der Paketdaten-Kommunikationskanal freigegeben worden ist.

45. Mobilstation (MS), die angepasst ist, um in einem Funktelefonsystem betrieben zu werden, das eine feste Station (BTS, BSC, MSC, Agent) umfasst, wobei die Mobilstation angepasst ist, um einen Parameter zu speichern, der die feste Station betrifft,
wobei die Mobilstation dazu in der Lage ist, durch Benutzen des Parameters, den die Mobilstation speichert und der die feste Station betrifft, sowie eines Parameters, den die feste Station speichert und die Mobilstation betrifft, einen virtuellen Datenkommunikationskanal zwischen sich selbst und der festen Station zu bilden, **dadurch gekennzeichnet, dass** eine Verschlüsselung für den virtuellen Datenkommunikationskanal eingerichtet worden ist, der jedoch keinen reservierten Kanal aufweist, so dass ein Paketdaten-Kommunikationskanal ohne weiteres erstellt werden kann, wenn Daten zwischen der Mobilstation und der festen Station ausgetauscht werden sollen, indem ein Pfad für den virtuellen Datenkommunikationskanal reserviert wird.

46. Mobilstation (MS) nach Anspruch 45, die angepasst ist, um den Parameter zu speichern, wenn sich die Mobilstation bei der festen Station (BTS, BSC, MSC, Agent) registriert.

47. Mobilstation (MS) nach Anspruch 45 oder Anspruch 6, die angepasst ist, um den Parameter zu speichern, wenn die Mobilstation bei der festen Station (BTS, BSC, MSC, Agent) registriert ist und die Einrichtung eines Paketdaten-Kommunikationskanals anfordert.

48. Feste Station (BTS, BSC, MSC, Agent), die angepasst ist, um in einem Funktelefonsystem betrieben zu werden, das eine Mobilstation (MS) umfasst, wobei die feste Station angepasst ist, um einen Parameter zu speichern, der die Mobilstation betrifft,
wobei die feste Station dazu in der Lage ist, durch Benutzen des Parameters, den die feste Station speichert und der die Mobilstation betrifft, sowie eines Parameters, den die Mobilstation speichert und der die feste Station betrifft, einen virtuellen Datenkommunikationskanal zwischen sich selbst und der Mobilstation zu bilden, **dadurch gekennzeichnet, dass** eine Verschlüsselung für den virtuellen Datenkommunikationskanal eingerichtet worden ist, der jedoch keinen reservierten Kanal aufweist, so dass ein Paketdaten-Kommunikationskanal ohne weiteres erstellt werden kann, wenn Daten zwischen der Mobilstation und der festen Station ausgetauscht werden sollen, indem ein Pfad für den virtuellen Datenkommunikationskanal reserviert wird.

49. Feste Station (BTS, BSC, MSC, Agent) nach Anspruch 48, die angepasst ist, um den Parameter zu speichern, wenn sich das Funktelefon bei der festen Station (BTS, BSC, MSC, Agent) registriert.

50. Feste Station (BTS, BSC, MSC, Agent) nach Anspruch 48 oder Anspruch 49, die angepasst ist, um den Parameter zu speichern, wenn das Funktelefon bei der festen Station (BTS, BSC, MSC, Agent) registriert ist und die Einrichtung eines Paketdaten-Kommunikationskanals anfordert.

51. Feste Station (BTS, BSC, MSC, Agent) nach einem der vorhergehenden Ansprüche, in welcher der virtuelle Kommunikationskanal erhalten werden kann, nachdem der Paketdaten-Kommunikationskanal freigegeben worden ist.

50 Revendications

1. Système radiotéléphonique comportant une station mobile (MS) et une station fixe (BTS, ESC, MSC, Agent), la station mobile étant capable de stocker un premier paramètre, se rapportant à la station fixe, et la station fixe étant capable de stocker un deuxième paramètre, se rapportant à la station mobile,
le premier et le deuxième paramètres peuvent être utilisés pour former une voie de communication de données virtuelle entre la station mobile et la station fixe pour laquelle une authentification a été effectuée et **caractérisé en ce que** pour ladite la voie de communication de données virtuelle, un cryptage a été arrangé mais qui ne possède pas de chemin réservé, afin qu'une voie de communication de données de paquets puisse être

aisément établie quand des données de paquets doivent être transmises entre la station mobile et la station fixe en réservant un chemin pour la voie de communication de données virtuelle.

2. Système selon la revendication 1, adapté pour former la voie de communication de données virtuelle quand une station mobile (MS) ayant des capacités de communication de données est enregistrée avec la station fixe (BTS, BSC, MSC, Agent).

5 3. Système selon la revendication 1 ou la revendication 2, adapté pour former la voie de communication de données virtuelle quand une station mobile (MS) enregistrée avec la station fixe (BTS, BSC, MSC, Agent) demande l'établissement d'une voie de communication de paquets.

10 4. Système selon l'une quelconque des revendications 1 à 3, comprenant en outre un moyen pour former des voies de trafic, généralement réservées pour la communication de parole entre la station mobile (MS) et la station fixe (BTS, BSC, MSC, Agent), et dans lequel une voie généralement réservée pour la communication de la parole (TCH) est le chemin réservé pour la voie de communication de paquets.

15 5. Système selon l'une quelconque des revendications 1 à 3, comprenant en outre un moyen pour former des voies de commande entre la station mobile (MS) et la station fixe (BTS, BSC, MSC, Agent), et dans lequel une voie de commande (RACH, PCH, AGCH) est le chemin réservé pour la voie de communication de données de paquets.

20 6. Système selon l'une quelconque des revendications précédentes, dans lequel on prévoit un moyen de commande (Agent) pour commander la communication entre la station mobile (MS), la station fixe (BTS, BSC, MSC, Agent) et un réseau de communication externe (réseau étendu, LAN éloigné).

25 7. Système selon l'une quelconque des revendications précédentes pour fournir un service de données comprenant un réseau cellulaire temporel numérique ayant un centre de commutation mobile (MSC), un contrôleur de station de base (BSC) connecté à celui-ci, et une pluralité de stations de base (BTS) connectées au contrôleur de station de base, et une pluralité de stations mobiles (MS), le système comportant un moyen pour former une voie de trafic pour le transfert de la parole et des données et des voies de commande associées à la voie de trafic entre la station mobile et la station de base, les voies de commande comprenant :

30 - une voie d'accès aléatoire (RACH), sur laquelle les stations mobiles demandent une voie de trafic,
- une voie de messagerie commune (PCH), sur laquelle une station de base envoie un signal de messagerie à une station mobile,
35 - une voie d'allocation des accès (AGGH), sur laquelle la station de base informe la station mobile de la voie de trafic attribuée à celle-ci,

40 dans lequel le moyen de commande est une unité de service de données de paquets (Agent) et est connecté au centre de commutation mobile, pour connecter le réseau cellulaire à un réseau de données (réseau étendu, LAN éloigné).

8. Système selon la revendication 7 comprenant :

45 - un moyen pour commuter au moins un parmi la pluralité de stations mobiles (MS) sur l'unité de service de données de paquets (Agent) et signaler l'établissement d'une connexion au réseau de données,
- un moyen dans une station mobile et l'unité de service de données de paquets pour stocker un certain nombre de paramètres se rapportant les uns aux autres, les paramètres incluant un protocole de liaison radio et formant la voie de communication de données virtuelle,

50 - un moyen, sensible à une demande d'une station mobile de transfert ou de réception de paquets de données, pour assembler une voie de transfert de données de paquets entre la station mobile et l'unité de service de données de paquets, en utilisant les paramètres de la voie de communication de données virtuelle, et dans lequel la voie de transfert de données de paquets comporte une première partie comportant une voie radio entre la station mobile et la station de base (BTS) et une deuxième partie comportant une tranche de temps dans une ligne de jonction numérique entre la station de base et l'unité de service de données de paquets,

55 - un moyen pour transférer des paquets de données sur la voie de transfert des données de paquets,
- un moyen, sensible à la fin du transfert de paquet de données sur la voie de transfert des données de paquets, pour désassembler au moins la voie radio, et
- un moyen pour maintenir la voie virtuelle jusqu'à la libération d'une station mobile de l'unité de service de

données de paquets.

9. Système selon la revendication 7 ou la revendication 8, dans lequel l'unité de service de données de paquets (Agent) comporte un moyen pour :

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- enregistrer toutes les stations mobiles (MS) connectées à un service de données de paquets sous le contrôle du centre de commutation mobile (MSC) dans un registre,
- informer la station mobile de tous les paquets de données adressés à celle-ci,
- transférer les paquets de données envoyés par la station mobile adressée au réseau,
- transférer des messages à la station mobile depuis le réseau,
- mettre en mémoire tampon des paquets de données,
- crypter/décrypter,
- compresser/décompresser les données envoyées vers et depuis la station mobile,
- mettre à jour une base de données de l'emplacement des stations mobiles,
- recevoir les paquets de données adressés à la voie de messagerie (PCH),
- retirer la station mobile du registre lorsqu'elle est déconnectée du service de données de paquets.

10. Système selon l'une quelconque des revendications 7 à 9, dans lequel l'unité de service de données de paquets (Agent) est capable d'adapter les paquets de données de la couche réseau vers des paquets virtuels de protocole de voie, les paquets virtuels de protocole de voie étant constitués d'une ou de plusieurs trames de protocole du trafic radio

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11. Système selon la revendication 10, dans lequel un paquet virtuel de protocole de voie comporte une partie d'identification indiquant si le contenu d'un paquet contient des données de signalisation ou un paquet de données de couche supérieure.

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12. Système selon l'une quelconque des revendications 7 à 11, dans lequel quand une station mobile (MS) veut transmettre des paquets de données, elle envoie sur la voie d'accès aléatoire (RACH) une demande pour établir la voie de communication de données de paquets, la demande étant une modification de la demande standard du réseau.

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13. Système selon l'une quelconque des revendications 7 à 12, dans lequel quand des paquets de données sont transférés à la station mobile (MS), la station de base (BTS) envoie un message à la station mobile sur la voie de messagerie commune (PCH) au sujet d'un transfert de paquet de données à venir, après quoi la station mobile envoie sur la voie d'accès aléatoire (RACH) une demande à la station de base pour établir la voie de communication de données de paquets, la demande étant une modification de la demande de voie standard du réseau.

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14. Système selon la revendication 12 ou 13, dans lequel la station de base (BTS) émet vers la station mobile (MS) des données de voie de commande utilisées pour la signalisation et des données concernant la voie à réserver en formant la voie de communication de données de paquets.

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15. Système selon la revendication 14, dans lequel après la signalisation entre la station mobile (MS) et l'unité de service de données de paquets (Agent), la deuxième partie de la voie de transfert de données de paquets est établie, grâce à quoi toute la voie de transfert de données de paquets est prête pour le transfert de paquets.

16. Système selon la revendication 15, dans lequel la signalisation est effectuée sur une voie à accès rapide (FACCH) dédiée du réseau.

17. Système selon l'une quelconque des revendications 7 à 16, dans lequel la deuxième partie de la voie de transfert de données de paquets est une connexion PCM directe du contrôleur de station de base (BSC) de la station de base (BTS) jusqu'à l'unité de service de données de paquets (Agent), grâce à quoi la deuxième partie de la voie de transfert de données de paquets est active qu'un transfert de données de paquets soit en cours ou non.

18. Système selon l'une quelconque des revendications 7 à 17, dans lequel la deuxième partie de la voie de transfert de données de paquets est un intervalle de temps variable sur la ligne de jonction PCM, grâce à quoi la deuxième partie est désassemblée après la fin du transfert de données de paquets.

19. Système selon l'une quelconque des revendications 7 à 18, dans lequel la première partie de la voie de transfert de données de paquets comprend une voie de trafic (TCH).

20. Système selon l'une quelconque des revendications 7 à 18, dans lequel la première partie de la voie de transfert de données de paquets comporte une voie d'accès aléatoire (RACH) quand des données de paquets sont transférées de la station mobile (MS) vers l'unité de service de données de paquets (Agent) et comporte la voie de messagerie commune (PCH) quand des données de paquets sont transférées de l'unité de service de données de paquets vers la station mobile.

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21. Système selon l'une quelconque des revendications 7 à 18, dans lequel au cours d'un transfert des données de paquets, la première partie de la voie de transfert de données de paquets est sélectionnée dans un groupe constitué de la voie de trafic (TCH), la voie d'accès aléatoire (RACH) et la voie de messagerie commune (PCH).

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22. Système selon l'une quelconque des revendications 7 à 21, dans lequel un message de messagerie de diffusion générale transmis à toutes les stations mobiles (MS) d'une cellule et un message de messagerie de multidiffusion transmis à certaines stations mobiles sont transmis sur la section de données d'un protocole de diffusion générale et de multidiffusion respectivement.

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23. Système selon l'une quelconque des revendications précédentes, dans lequel le premier et le deuxième paramètres sont ceux utilisés dans l'authentification.

24. Système selon l'une quelconque des revendications précédentes, dans lequel le premier et le deuxième paramètres sont ceux utilisés dans le cryptage.

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25. Système selon l'une quelconque des revendications précédentes, dans lequel le premier et le deuxième paramètres sont ceux utilisés en formant un protocole de liaison radio.

26. Système selon l'une quelconque des revendications précédentes, dans lequel au moins un parmi le premier et le deuxième paramètres est un numéro d'identification provisoire (TMSI).

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27. Système selon l'une quelconque des revendications précédentes, comprenant un moyen pour former la voie de communication de données virtuelle en envoyant une demande de voie de la station mobile (MS) vers la station fixe (BTS, BSC, MSC, Agent), un moyen pour attribuer une voie radio, un moyen pour authentifier la station mobile sur la voie radio attribuée, un moyen pour lancer une communication cryptée entre la station mobile et la station fixe et un moyen pour attribuer un numéro d'identification provisoire (TMSI) à la station mobile.

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28. Système selon la revendication 27, dans lequel la voie radio attribuée est une voie de commande.

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29. Système selon l'une quelconque des revendications précédentes comportant un moyen pour former la voie de communication de données virtuelle en établissant un protocole de liaison radio et maintenant le protocole de liaison radio jusqu'à ce que la station mobile (MS) soit libérée du service de paquet de données.

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30. Système selon l'une quelconque des revendications précédentes, dans lequel la voie de communication virtuelle peut être maintenue après que la voie de communication de données de paquets est libérée.

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31. Procédé pour transmettre des données dans un réseau radiotéléphonique comprenant :

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stocker un premier paramètre, se rapportant à une station fixe (BTS, BSC, MSC, Agent), dans une station mobile (MS) ;
stocker un deuxième paramètre, se rapportant à la station mobile, dans la station fixe ;
former une voie de communication de données virtuelle en utilisant le premier et le deuxième paramètres entre la station mobile et la station fixe pour laquelle une authentification a été effectuée et caractérisé en ce que pour ladite la voie de communication de données virtuelle, un cryptage a été arrangé mais qui ne possède pas de chemin réservé, afin qu'une voie de communication de données de paquets puisse être aisément établie quand des données doivent être transmises entre la station mobile et la station fixe en réservant un chemin pour la voie de communication de données virtuelle.

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32. Procédé selon la revendication 31, comprenant en outre former la voie de communication de données virtuelle quand une station mobile (MS) ayant des capacités de communication de données est enregistrée avec la station fixe (BTS, BSC, MSC, Agent).

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33. Procédé selon la revendication 31 ou la revendication 32, comprenant en outre former la voie de communication de données virtuelle quand une station mobile (MS) enregistrée avec la station fixe (BTS, BSC, MSC, Agent) demande l'établissement d'une voie de communication de données de paquets.

5 34. Procédé selon l'une quelconque des revendications 31 à 33, comprenant en outre réserver une voie de communication généralement réservée pour la communication de la parole pour la voie de communication de données de paquets.

10 35. Procédé selon l'une quelconque des revendications 31 à 34, comprenant en outre réserver une voie de commande pour la voie de communication de données.

36. Procédé selon l'une quelconque des revendications 31 à 35, dans lequel le premier et le deuxième paramètres utilisés pour établir la voie de communication de données sont ceux utilisés dans l'authentification.

15 37. Procédé selon l'une quelconque des revendications 31 à 36, dans lequel le premier et le deuxième paramètres utilisés pour établir la voie de communication de données sont ceux utilisés dans le cryptage.

20 38. Procédé selon l'une quelconque des revendications 31 à 37, dans lequel le premier et le deuxième paramètres utilisés pour établir la voie de communication de données sont ceux utilisés dans la formation d'un protocole de liaison radio.

39. Procédé selon l'une quelconque des revendications 31 à 38, dans lequel au moins un parmi le premier et le deuxième paramètres est un numéro d'identification provisoire (TMSI).

25 40. Procédé selon l'une quelconque des revendications précédentes, comprenant les étapes consistant à former la voie de communication de données virtuelle en envoyant une demande de voie de la station mobile (MS) vers la station fixe (BTS, BSC, MSC, Agent), attribuer une voie radio, authentifier la station mobile sur la voie radio attribuée, lancer une communication cryptée entre la station mobile et la station fixe, puis attribuer un numéro d'identification provisoire (TMSI) à la station mobile.

30 41. Procédé selon la revendication 40, dans lequel la voie radio attribuée est une voie de commande.

42. Procédé selon l'une quelconque des revendications 31 à 41, comportant les étapes consistant à former la voie de communication de données virtuelle en établissant un protocole de liaison radio et maintenant le protocole de liaison radio jusqu'à ce que la station mobile (MS) soit libérée du service de paquet de données.

35 43. Procédé selon l'une quelconque des revendications 31 à 42, dans lequel le moyen de commande (Agent) commande la communication entre la station mobile (MS), la station fixe (NTS, BSC, MSC, Agent) et un réseau de communication externe (réseau étendu, LAN éloigné).

40 44. Procédé selon l'une quelconque des revendications précédentes, dans lequel la voie de communication virtuelle peut être maintenue après que la voie de communication de données de paquets est libérée.

45 45. Station mobile (MS) adapté pour fonctionner dans un système radiotéléphonique comportant une station fixe (BTS, BSC, MSC, Agent), la station mobile étant adaptée pour stocker un paramètre se rapportant à la station fixe, la station mobile est capable de former une voie de communication de données virtuelle entre elle-même et la station fixe en utilisant le paramètre relatif à la station mobile que la station fixe stocke ainsi qu'un paramètre relatif à la station fixe que la station mobile stocke pour laquelle une authentification a été effectuée et caractérisé en ce que pour ladite la voie de communication de données virtuelle, un cryptage a été arrangé mais qui ne possède pas de chemin réservé, afin qu'une voie de communication de données de paquets puisse être aisément établie quand des données doivent être transmises entre la station mobile et la station fixe en réservant un chemin pour la voie de communication de données virtuelle.

50 46. Station mobile (MS) selon la revendication 45, adaptée pour stocker le paramètre lorsque la station mobile est enregistrée avec la station fixe (BTS, BSC, MSC, Agent).

47. Station mobile (MS) selon la revendication 45 ou la revendication 6, adapté pour stocker le paramètre lorsque la station mobile est enregistrée avec la station fixe (BTS, BSC, MSC, Agent) et demande l'établissement d'une voie

de communication de données de paquets.

5 48. Station fixe (BTS, BSC, MSC, Agent), adaptée pour fonctionner dans un système radiotéléphonique comportant une station mobile (MS), la station fixe étant adaptée pour stocker un paramètre se rapportant à la station mobile, la station fixe est capable de former une voie de communication de données virtuelle entre elle-même et la station mobile en utilisant le paramètre relatif à la station mobile que la station fixe stocke ainsi qu'un paramètre relatif à la station fixe que la station mobile stocke pour laquelle une authentification a été effectuée et **caractérisé en ce que** pour ladite la voie de communication de données virtuelle, un cryptage a été arrangé mais qui ne possède pas de chemin réservé, afin que la voie de communication de données de paquets puisse être aisément établie quand des données doivent être transmises entre la station mobile et la station fixe en réservant un chemin pour la voie de communication de données virtuelle.

10 49. Station fixe (BTS, BSC, MSC, Agent) selon la revendication 48, adaptée pour stocker le paramètre lorsque le radiotéléphone est enregistré avec la station fixe (BTS, BSC, MSC, Agent).

15 50. Station fixe (BTS, BSC, MSC, Agent) selon la revendication 48 ou la revendication 49, adapté pour stocker le paramètre lorsque le radiotéléphone est enregistré avec la station fixe (BTS, BSC, MSC, Agent) et demande l'établissement d'une voie de communication de données de paquets.

20 51. Station fixe (BTS, BSC, MSC, Agent) selon l'une quelconque des revendications précédentes, dans lequel la voie de communication virtuelle peut être maintenue après que la voie de communication de données de paquets est libérée.

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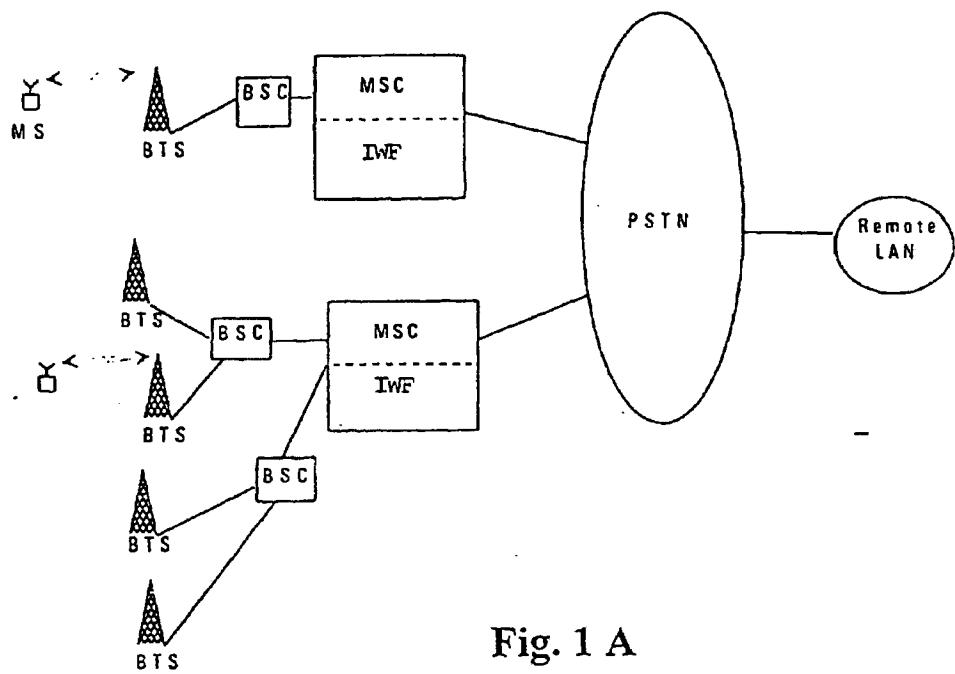


Fig. 1 A

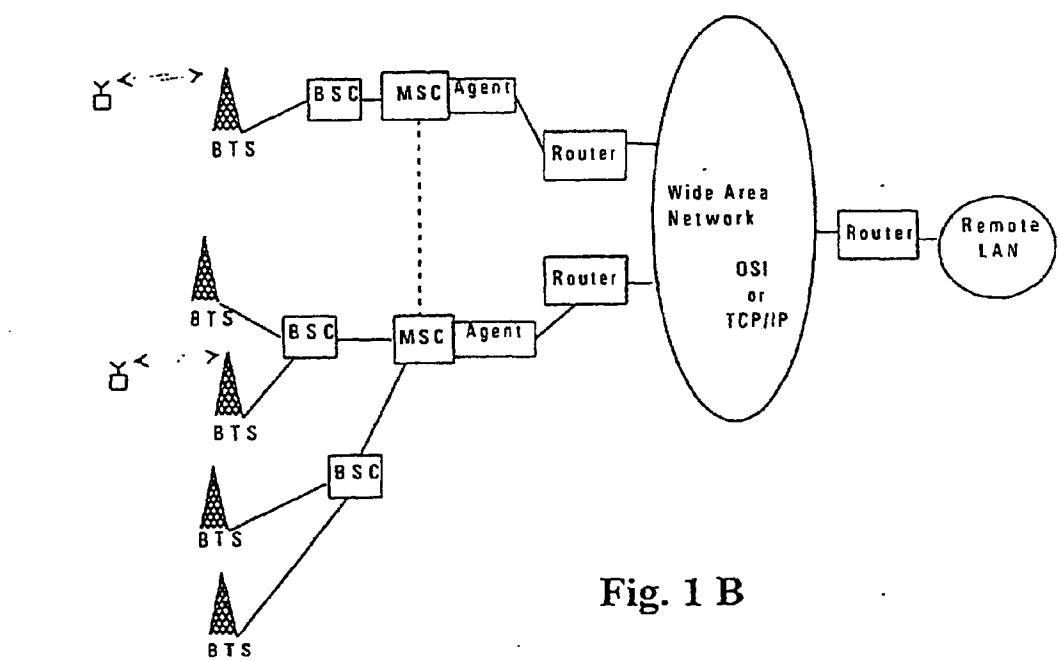


Fig. 1 B

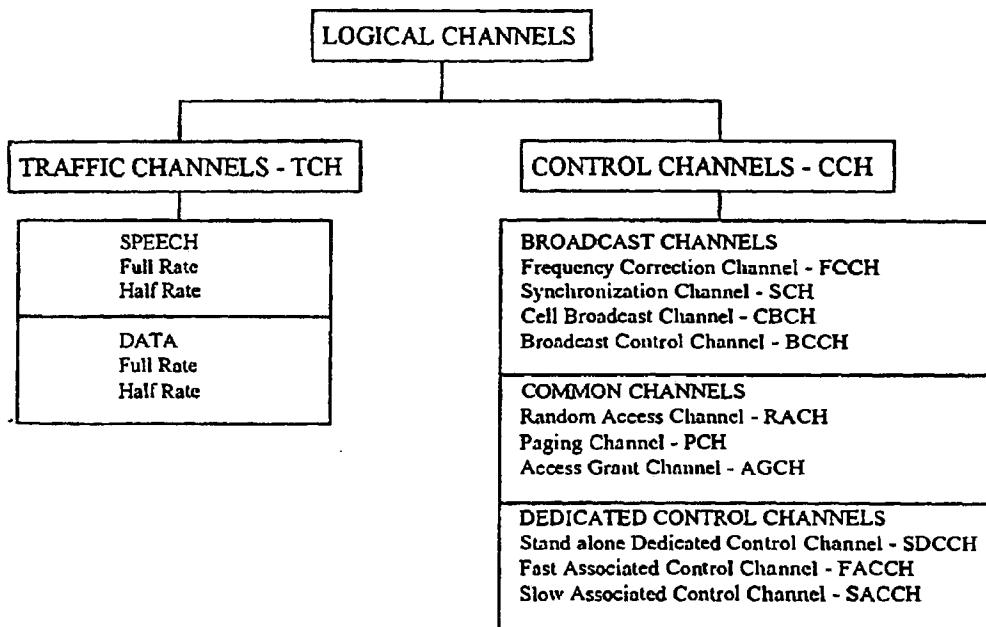


Fig. 2



Fig. 3

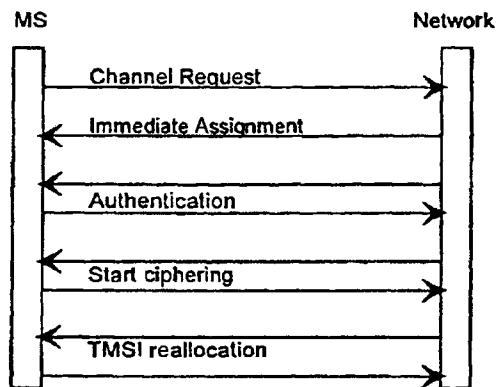


Fig. 4

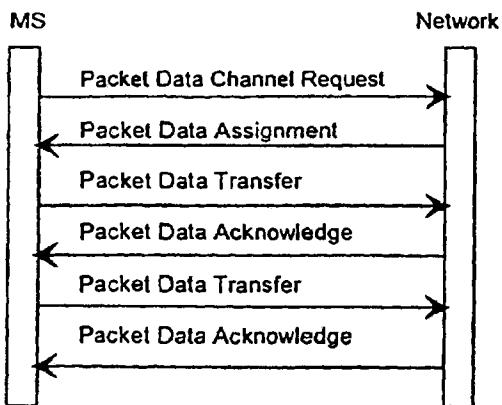


Fig. 5

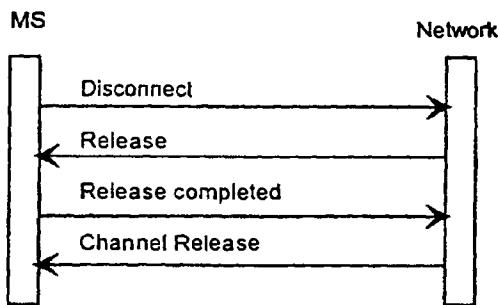


Fig. 6

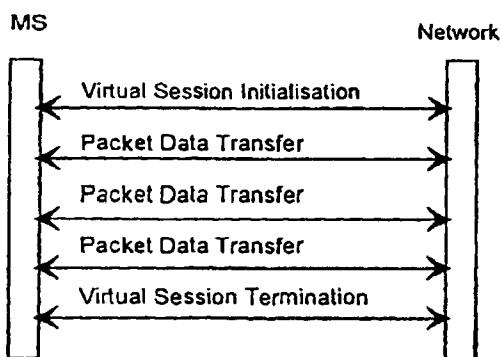


Fig. 7

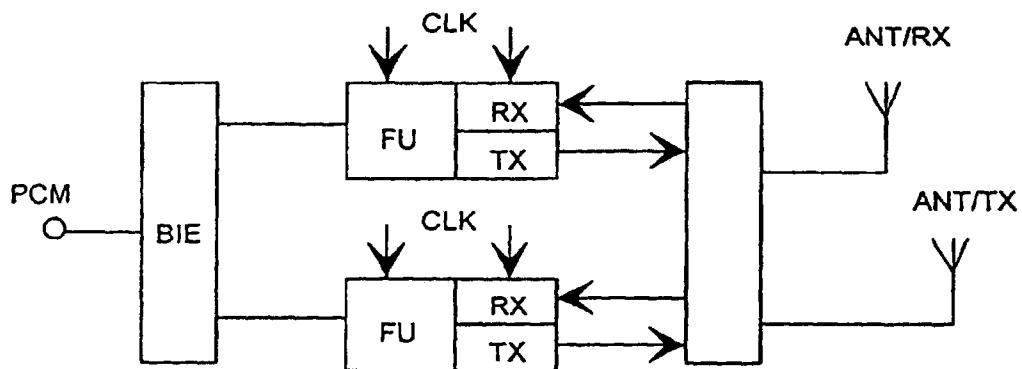


Fig. 8

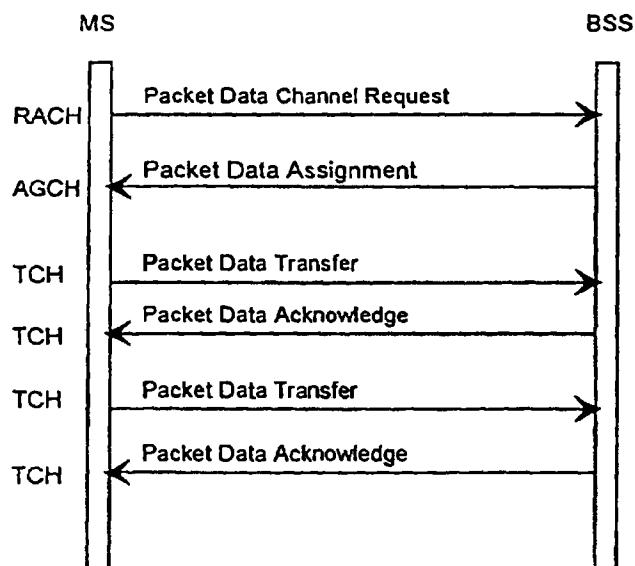


Fig. 9

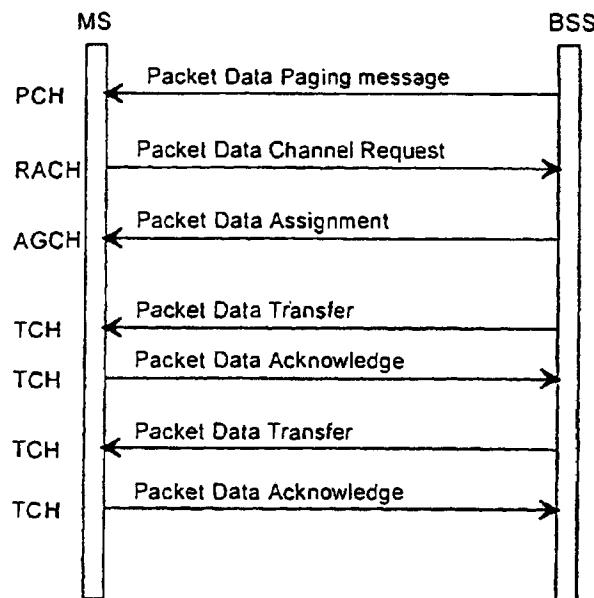


Fig. 10



Fig. 11

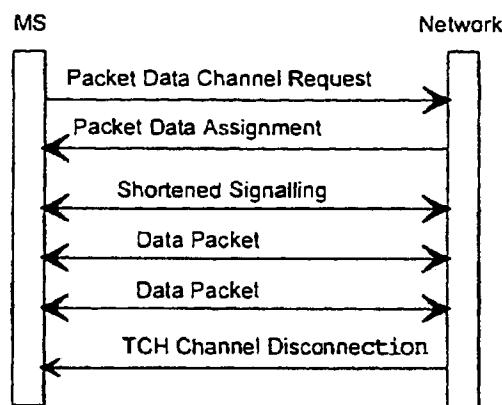


Fig. 15

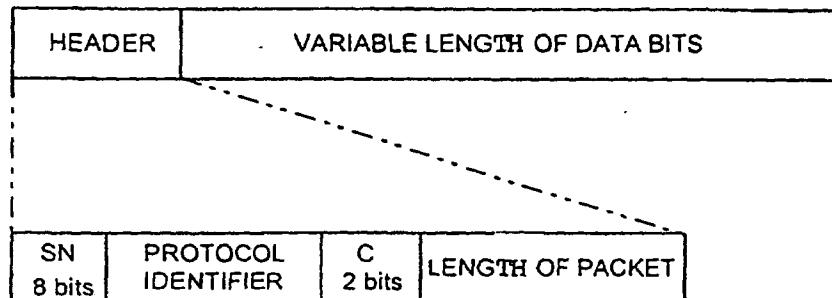


Fig. 12

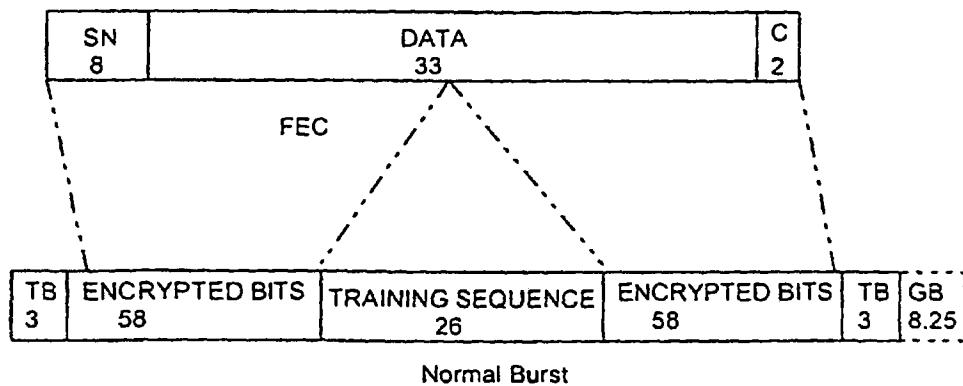


Fig. 13

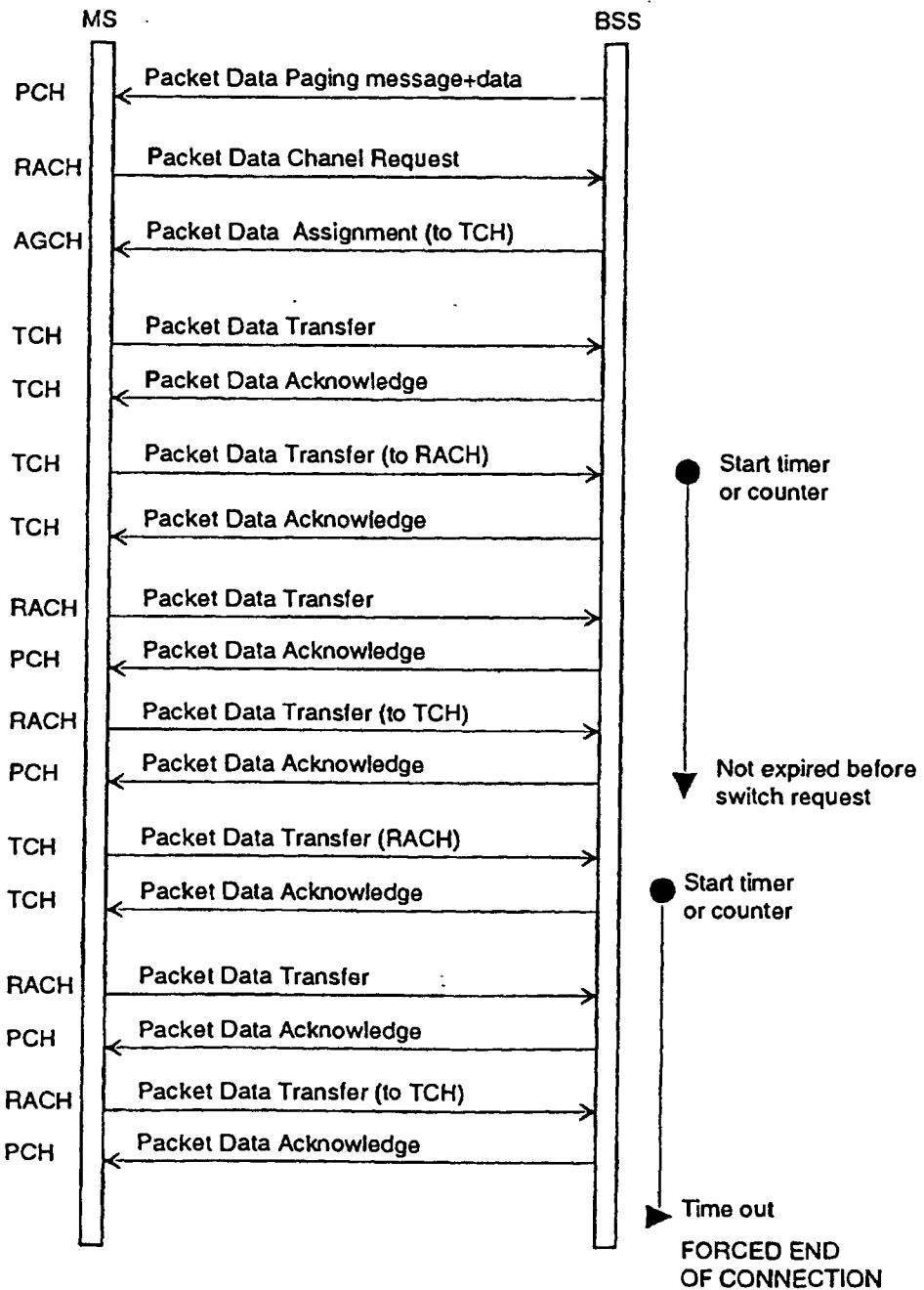


Fig. 14